GRADALL®

OPERATION & LUBRICATION MANUAL

G660E

8368-1834

July 2002
Starting S/N G016301

GRADALL
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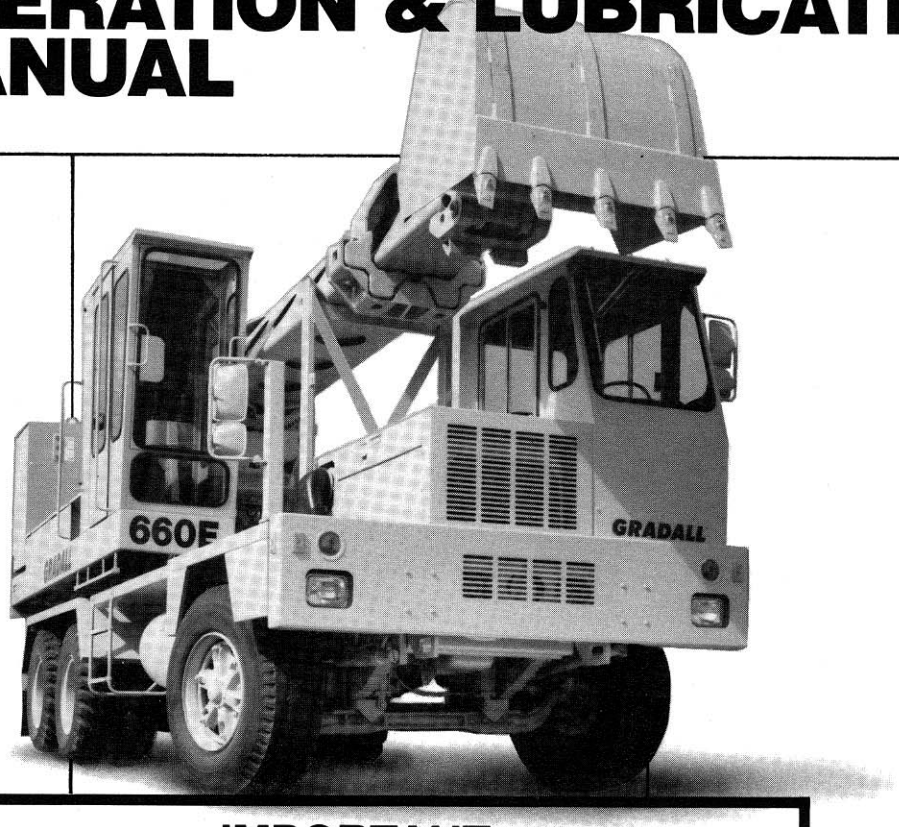
GRADALL®
HYDRAULIC EXCAVATORS

660E

6x4 & 6x6 CARRIER OPERATION & LUBRICATION MANUAL



IMPORTANT

Read and understand this manual, the 660E Upperstructure Operation Manual, the Gradall Safety Manual, the CIMA Safety Manuals, and all of the Gradall Service Manual Sections before starting, operating, or performing maintenance procedures on this machine.

KEEP THESE MANUALS IN CAB.

AVERTISSEMENT!
Si vous ne lisez pas l'anglais, demandez a votre surveillant de vous donner les instructions de securite!

ATENCION!
Si no lee ingles, pre-guntele a su supervisor para las instrucciones de seguridad!

VORSICHT!
Wen Sie kein Englisch lesen, bitten Sie ihren Vorgesetzten um die Sicherheitsvorschriften!

COVERS CARRIERS STARTING S/N G016301

Form No. 28804

Part No. 8368-1834

IMPORTANT SAFETY NOTICE

Safe operation depends on reliable equipment and proper operating procedures. Performing the checks and services described in this manual will help to keep your Gradall® Carrier in reliable condition and use of the recommended operating procedures can help you avoid accidents. Because some procedures may be new to even the experienced operator we recommend that this manual be read, understood and followed by all who operate the carrier.

Danger, Warning and Caution notes in this manual will help you avoid injury and damage to the equipment. These notes are not intended to cover all eventualities; it would be impossible to anticipate and evaluate all possible applications and methods of operation for this equipment.

Any procedure not specifically recommended by The Gradall Company must be thoroughly evaluated from the standpoint of safety before it is placed in practice. If you aren't sure, contact your Gradall Distributor before operating.

Do not modify this machine without written permission from the Gradall Company.

⚠ WARNING

BEFORE WELDING ON THIS MACHINE:

DISCONNECT BATTERY CABLES AND TURN OFF IGNITION BEFORE WELDING TO PREVENT DAMAGE.

THIS MACHINE IS EQUIPPED WITH NYLON AIR BRAKE HOSE. REMOVE AND/OR SHIELD THE NYLON HOSE ADEQUATELY IN THE IMMEDIATE AREA PRIOR TO WELDING.

NOTICE

The Gradall Company retains all proprietary rights to the information contained in this manual.

The Company also reserves the right to change specifications without notice.

The Gradall Company
406 Mill Avenue, S. W., New Philadelphia, Ohio 44663

Gradall is a registered trademark for hydraulic excavators, hydraulic material handlers and attachments built by the Gradall Company.

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Form 28804

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INTRODUCTION

General

This manual provides important information to familiarize you with required operator maintenance and with safe operating procedures for the Gradall wheeled excavator undercarriage.

Because two operators are sometimes assigned to the unit, operator information for the upperstructure and for the undercarriage is provided in separate manuals.

The undercarriage includes a separate operator's station for control of undercarriage functions and is equipped with a separate engine to propel the unit.

Throughout this manual, the term "carrier" will be used to designate the excavator undercarriage.

Related Manuals

Separate publications are furnished with the Gradall to provide information concerning safety, replacement parts, detailed maintenance procedures, vendor components and operation of the upperstructure.

You must read and understand the Gradall Upperstructure Operation & Lubrication Manual, the Gradall Hydraulic Excavators Safety Manual and the CIMA Hydraulic Excavator User's Safety Manual before operating the upperstructure.

If you have any questions regarding the Gradall Carrier or the Upperstructure, contact your Gradall Distributor; he is thoroughly familiar with the unit and will be happy to help you.

Operator Qualifications

The operator must hold a valid, applicable driver's license which requires acceptable age, vision, hearing, manual dexterity and response. He must also be in acceptable physical and mental condition (not undergoing medical treatment or using drugs or alcohol which would violate traffic laws.)

Before driving the unit on the highway or operating the excavator at a worksite, the operator must familiarize himself with the machine by practicing in a safe, open area not hazardous to people or property.

The operator must read, understand and comply with instructions contained in the following material furnished with the excavator.

This Operation & Lubrication Manual
CIMA DUMPER Safety Manual
All Instructional decals and plates

If driver will also operate upperstructure:

G-660E Upperstructure Operation & Lubrication Manual
Gradall Hydraulic Excavators Safety Manual
CIMA Hydraulic Excavator User's Safety Manual

Models Covered

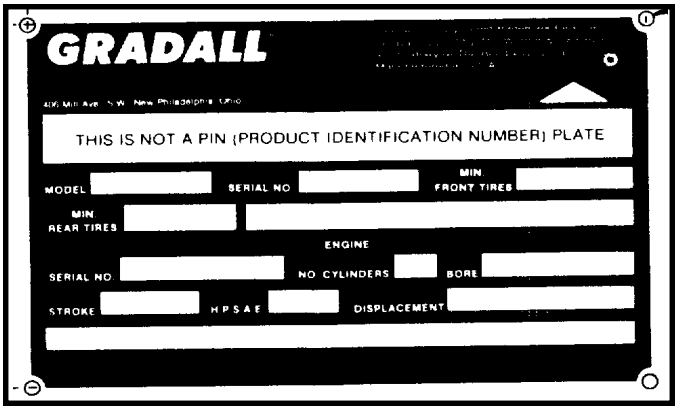
Wheeled carriers for the G-660E Gradall Hydraulic Excavators are furnished with the following basic carrier variations to suit job application and contractor preference:

Orientation

When used to indicate direction or location, the terms front, rear, left and right relate to the orientation of a man sitting in the driver's seat.

Serial Number Location

The carrier nameplate is located on the right side of the carrier frame. Be sure to specify the serial number (on nameplate) when ordering parts and when discussing procedures and applications with your distributor.



SAFETY HIGHLIGHTS

Read and understand this manual and "CIMA DUMPER Safety Manual" before starting, operating or performing maintenance procedures on this carrier. Do not permit this carrier to be driven by an operator who cannot read English unless these manuals have been read and explained to him and
his full understanding is determined. Keep these manualls in cab.

If driver will operate upperstructure, he must also read and understand Gradall Upperstructure Operation & Lubrication Manual, Gradall Hydraulic Excavators Safety Manual and CIMA Hydraulic Excavator User's Safety Manual.

Watch for these symbols; they are used to call your attention to safety notices.

⚠ DANGER

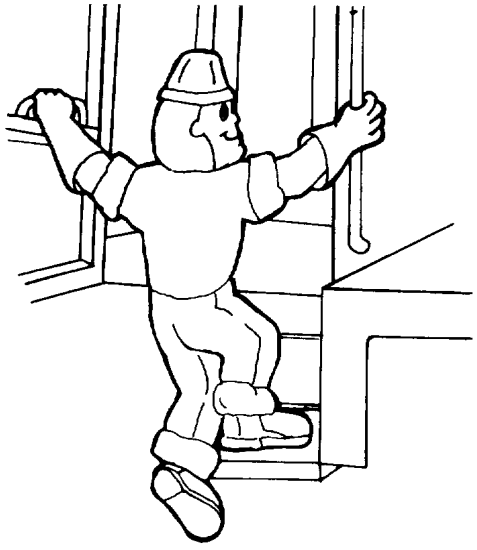
This symbol indicates an extreme hazard which would result in high probability of death or serious injury if proper precautions are not taken.

⚠ WARNING

This symbol indicates a hazard which could result in death or serious injury if proper precautions are not taken.

⚠ CAUTION

This symbol indicates a hazard which could result in injury or damage to equipment or property if proper precautions are not taken.



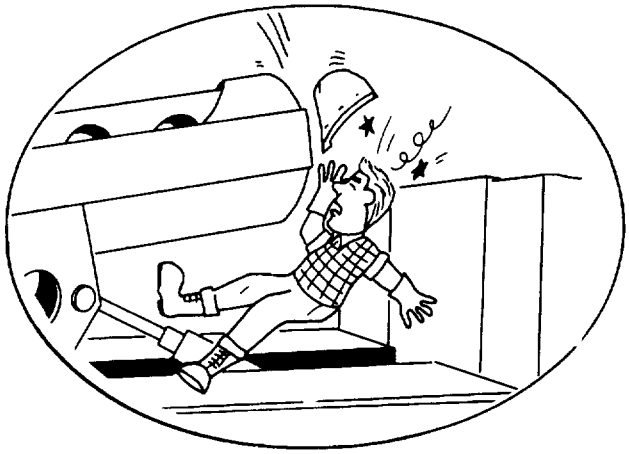
Maintain three point contact with grab handles and steps when climbing on and off the machine. **Never jump from the machine.**

Repair or replace damaged steps and grab handles.

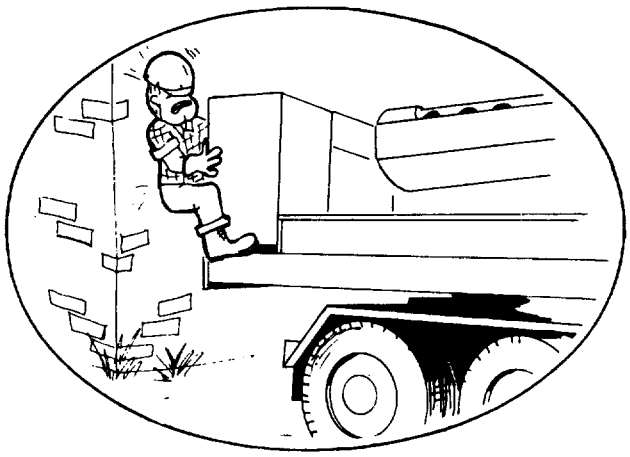
Perform all "CHECKS & SERVICES BEFORE STARTING ENGINE" (pages 11 & 12), "CHECKS AFTER STARTING THE ENGINE" (page 17) and "CHECKS BEFORE DRIVING" (page 17) before driving the carrier. **Complete all required maintenance before driving, the carrier.**

SAFETY HIGHLIGHTS

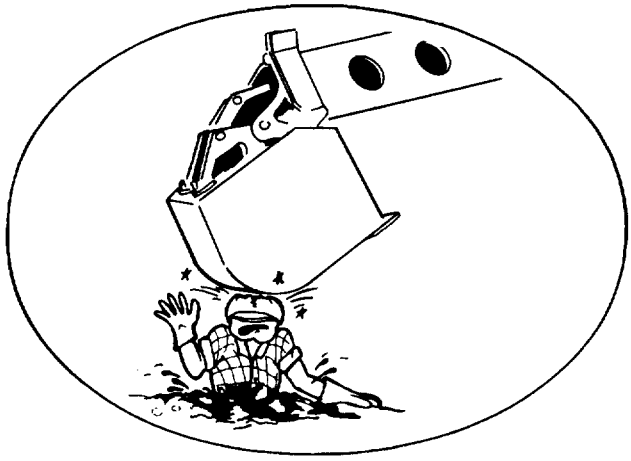
Learn to recognize 'PINCH POINTS'



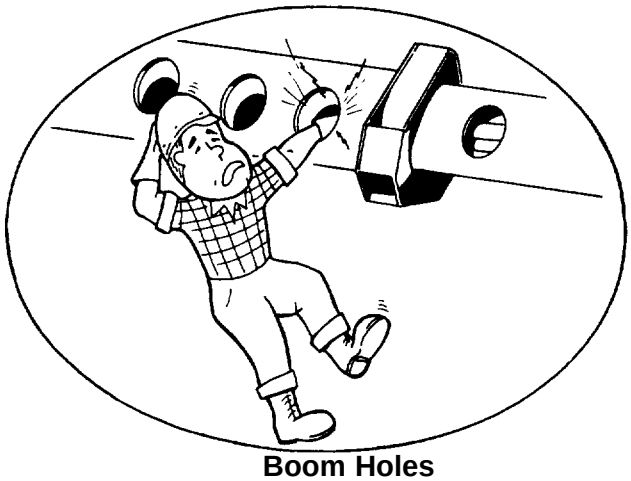
Boom Cradle



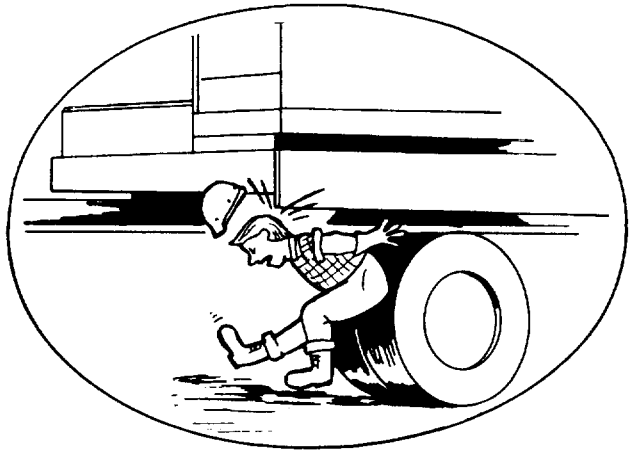
Counterweight & Another Object



Boom



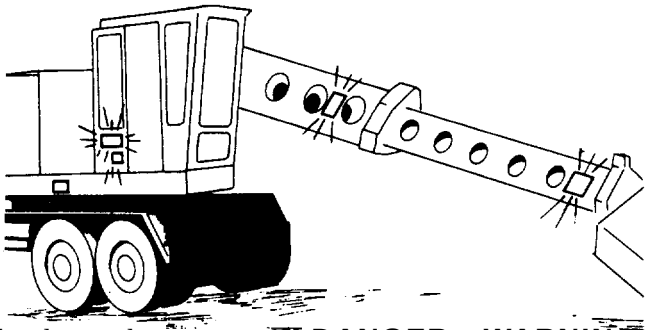
Boom Holes



Upperstructure & Carrier

Bucket & Linkage

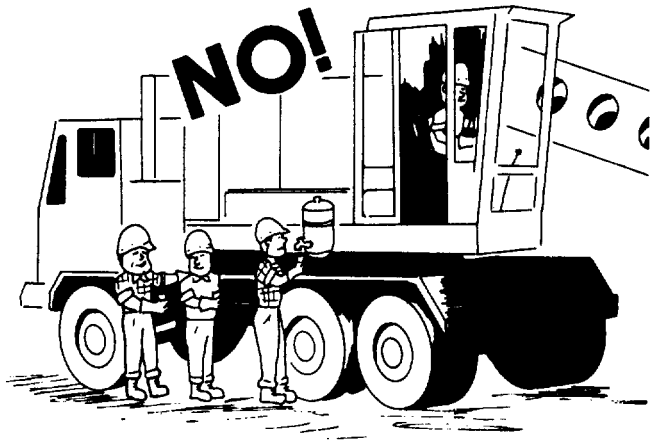
Learn to recognize "PINCH POINTS" and stay clear of them. Getting caught in a pinch point can cause serious injury or death.



Check to be sure all **DANGER, WARNING, CAUTION** and **INSTRUCTION DECALS** are in place and can be read. Clean or replace decals as required.

Keep steps and deck areas free of mud, oil, grease and other foreign material. Replace non-skid surface material as required.

Some owners alter their machines. Check to be sure your machine fits the pictures and description in this manual. If it differs, or if you aren't sure, contact your Gradall distributor before you run your unit.

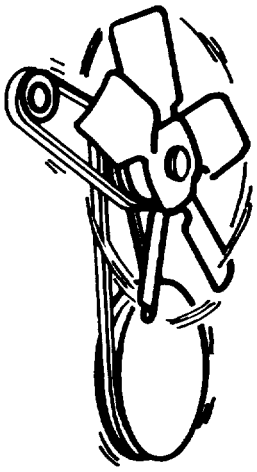


Never carry a water can, equipment, or other worker's tools or personal items on the machine. Such items can cause other workers to approach the machine without your knowledge and result in serious injury or death.

Sound Horn

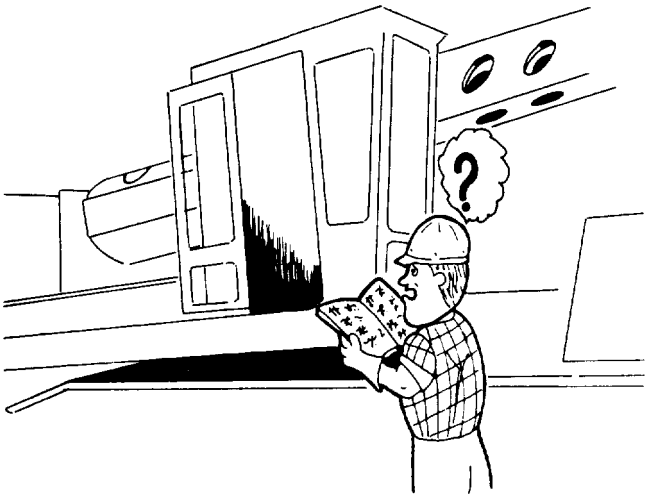
Always **sound horn** to warn others of unexpected machine movements (horn button is located at top of left joystick).

The unit is also equipped with an automatic **back-up alarm** to warn others of reverse travel.



Stay clear of moving tan, belts, pulleys, meshing gears, drive shafts and other moving parts. Do not operate without covers and guards in place.

SAFETY HIGHLIGHTS



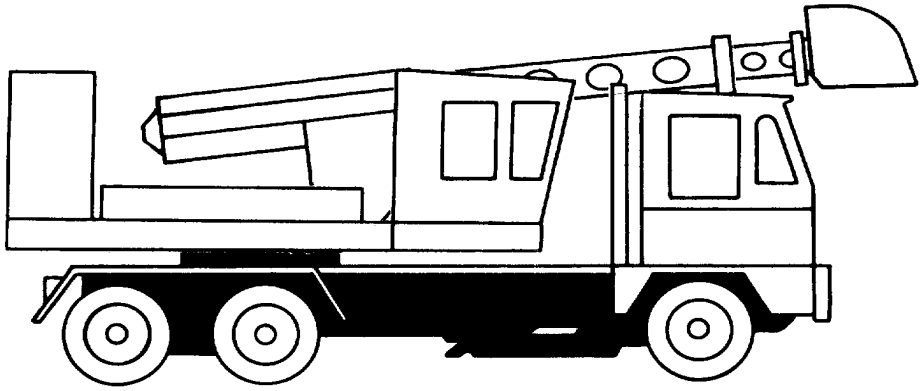
Be particularly careful if this is not the machine you usually operate. **Read the manuals** listed on page 2 and then **operate the unit** in a safe, open area to become familiar with the controls.

Learn and **follow your employer's safety rules.**

⚠ WARNING

Travel on off-highway grades is recommended only under the following conditions:

Boom secured in rest
Tires properly inflated
Surface is firm enough to support unit
Surface provides adequate traction to prevent slipping
Surface is firm enough to support unit enough to cause tipping
Transmission is in LL1, LL2 or LL3 gear range



TRAVEL TO AND FROM JOBSITE ONLY UNDER FOLLOWING CONDITIONS:

Boom secured in rest

Mirrors clean and properly adjusted

Seat belt buckled snugly across lap

Door secured in closed position

Plan your route

Bucket secured to boom

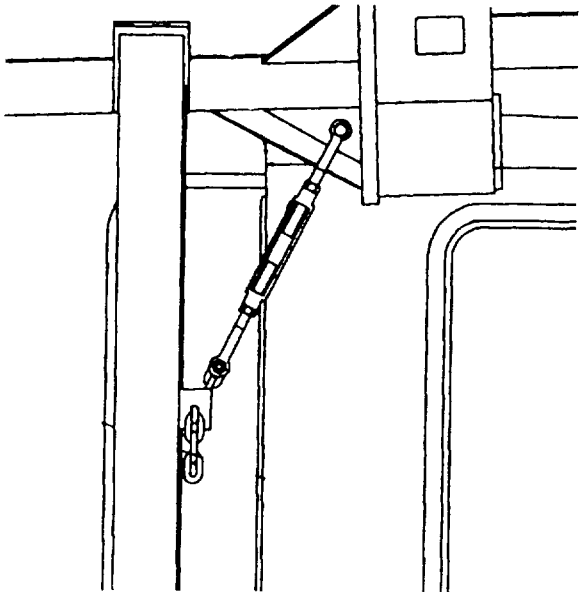
No load attached to any part of machine

Joystick switch in off position

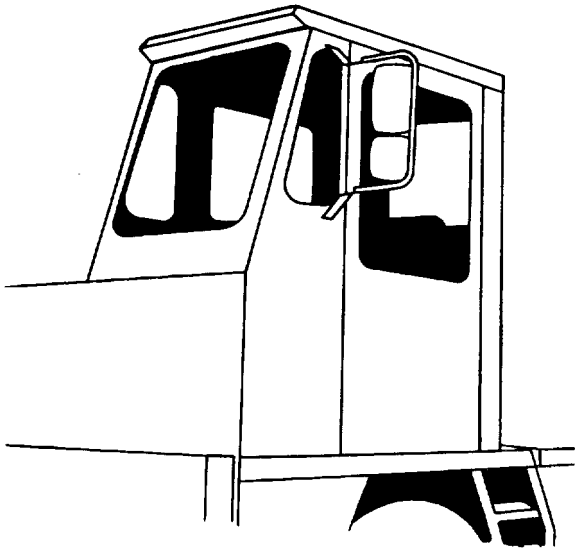
Travel in accordance with local requirements

Tires inflated to proper pressure

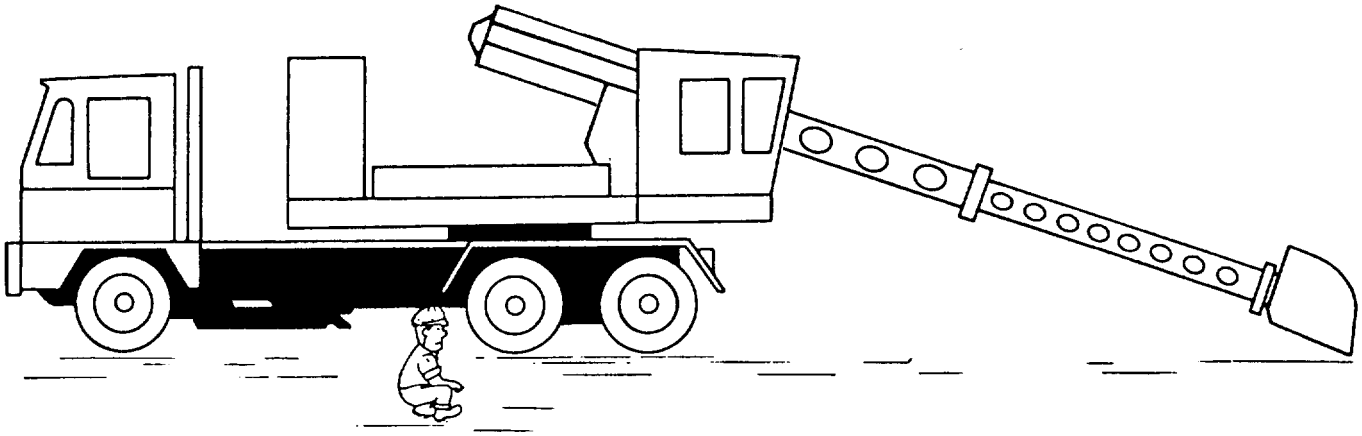
Upperstructure engine stopped



Use boom tie-down device to secure boom in rack when traveling between jobsites.



Check to be sure **windows and mirrors** are clean and that mirrors are properly adjusted for your driving position.



Test brakes before driving carrier after digging

TO TEST FOR BRAKE FAILURE:

1. Park machine on a level surface.

2. Apply digging brake.

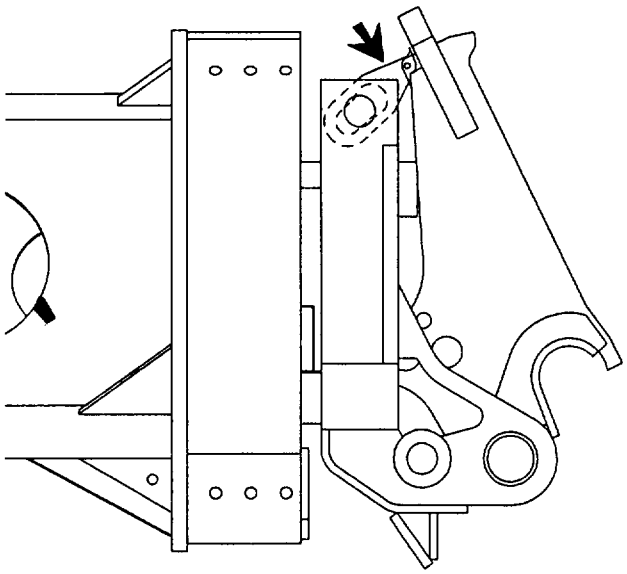
3. Center boom over rear of chassis and rest boom or bucket on the ground.

4. Apply down pressure with boom (but not enough to remove weight from wheels) and push and pull with boom while helper watches each rear wheel for rotation.

5. Rotation of any wheel during step 4 indicates brake failure on that wheel.

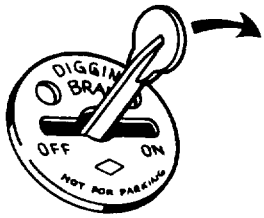
6. If one or more wheels indicate brake failure, **DO NOT DRIVE THE GRADALL HYDRAULIC EXCAVATOR**. Investigate and correct. For assistance, contact your Gradall Distributor.

SAFETY HIGHLIGHTS

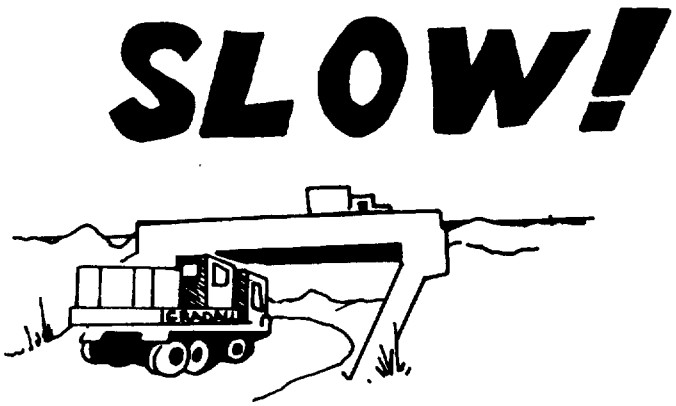


If required, **secure attachment** as shown to prevent drift while traveling.

Remember, **getting too close to unstable ground** or the edge of an excavation can **cause the machine to tip.**



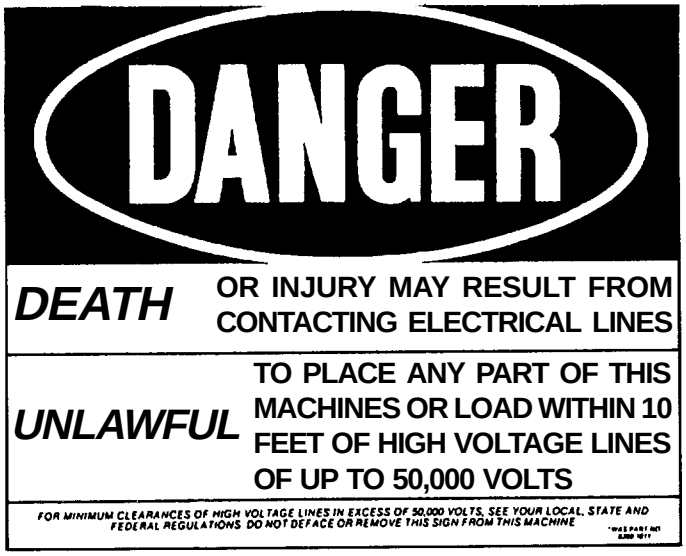
Always **apply digging brake** to prevent carrier movement **while operating upperstructure**



Know overall height of your unit before travelnig. Approach unknown clearances slowly.

Do not carry passengers or move the unit until all other persons have gotten off and are clear of the machine.

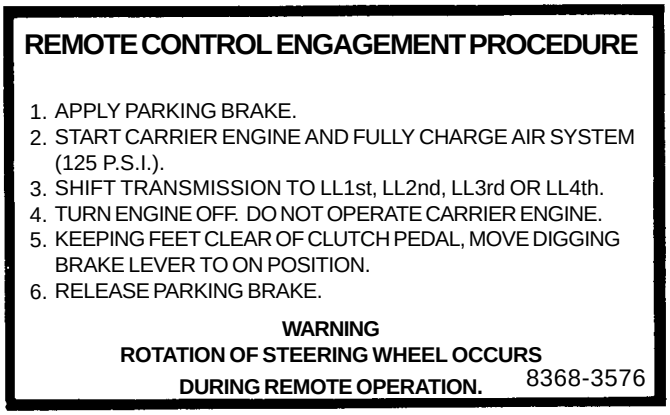
Decals Inside Cab


DANGER
DEATH
OR INJURY MAY RESULT FROM CONTACTING ELECTRICAL LINES
UNLAWFUL
TO PLACE ANY PART OF THIS MACHINES OR LOAD WITHIN 10 FEET OF HIGH VOLTAGE LINES OF UP TO 50,000 VOLTS
FOR MINIMUM CLEARANCES OF HIGH VOLTAGE LINES IN EXCESS OF 50,000 VOLTS, SEE YOUR LOCAL, STATE AND FEDERAL REGULATIONS. DO NOT DEFACE OR REMOVE THIS SIGN FROM THIS MACHINE

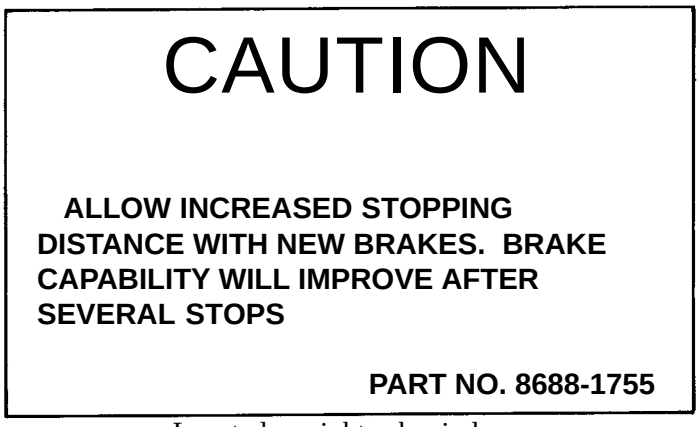
Located inside cab door
Part No. 8360-1011

WARNING
TO PREVENT INJURY, STAY CLEAR OF MOVING PARTS. FASTEN COVERS BEFORE STARTING ENGINE. READ SERVICE MANUAL BEFORE ADJUSTING OR SERVICING.
7702 3004

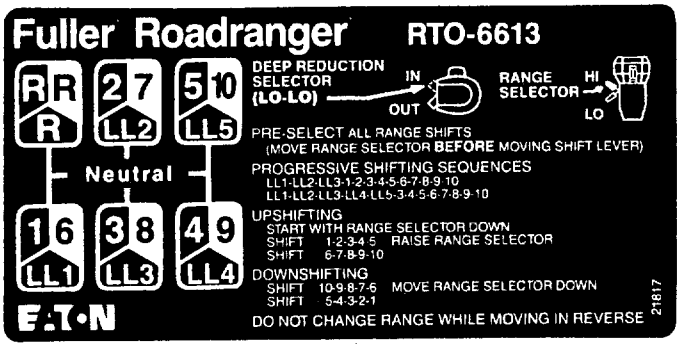
Located inside cab door & above engine compartment
Part No. 7702-3004


REMOTE CONTROL ENGAGEMENT PROCEDURE
1. APPLY PARKING BRAKE.
2. START CARRIER ENGINE AND FULLY CHARGE AIR SYSTEM (125 P.S.I.).
3. SHIFT TRANSMISSION TO LL1st, LL2nd, LL3rd OR LL4th.
4. TURN ENGINE OFF. DO NOT OPERATE CARRIER ENGINE.
5. KEEPING FEET CLEAR OF CLUTCH PEDAL, MOVE DIGGING BRAKE LEVER TO ON POSITION.
6. RELEASE PARKING BRAKE.
WARNING
ROTATION OF STEERING WHEEL OCCURS DURING REMOTE OPERATION.
8368-3576

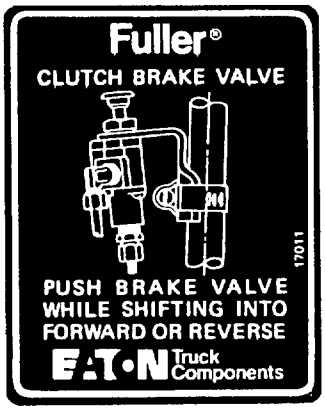
Located inside cab door
Part No. 8369-3576


CAUTION
ALLOW INCREASED STOPPING DISTANCE WITH NEW BRAKES. BRAKE CAPABILITY WILL IMPROVE AFTER SEVERAL STOPS
PART NO. 8688-1755

Located on right cab window
Part No. 8688-1755



Located on right cab window
Part No. 8368-3911



Located on right cab window
Part No. 8395-3002

Decals outside Cab

WARNING

USE TWO HANDS WHEN CLIMBING ON MACHINES

7702-3003

Located at right of cab door
Part No. 7702-3003

WARNING

KEEP CLEAR OF MACHINE SWING AREA

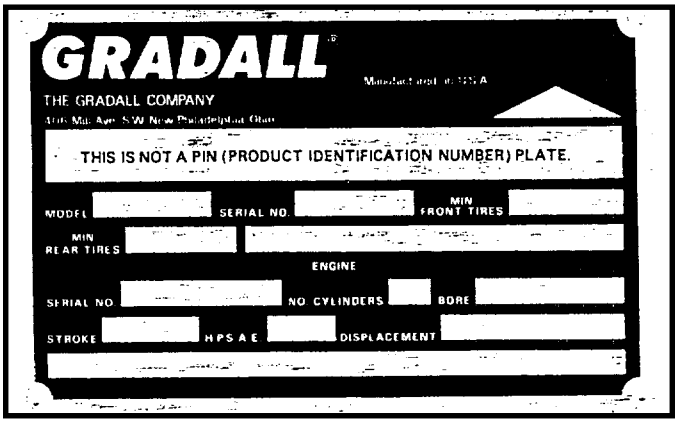
Located on back of cab
Part No. 8360-1018

CAUTION

NYLON BRAKE LINES MAY BE DAMAGED BY HEAT. AVOID WELDING ON OR AROUND CARRIER FRAME UNLESS LINES ARE PROTECTED FROM HEAT

Located on air reservoir
Part No. 7702-3002

Located on fan shroud
Part No. 9104-3210



Located on right frame rail
Part No. 7702-3029

IMPORTANT

To prevent damage to the electrical system when using booster battery or charger, always connect

(+) POSITIVE TO POSITIVE

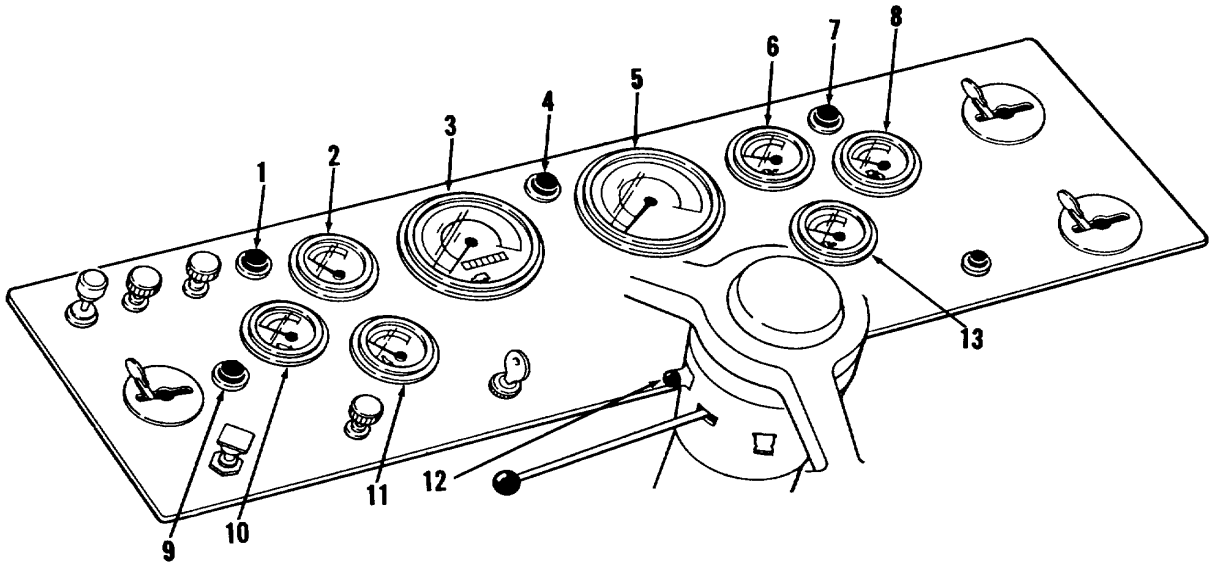
(-) NEGATIVE TO NEGATIVE

Located inside battery box cover
Part No. 7702-3007

DIESEL FUEL

Located above fuel tank
Part No. 7702-3008

INSTRUMENTS AND INDICATORS



1. Alternator Indicator Light

2. Voltmeter

3. Speedometer/Odometer

4. Hi/Lo Beam Indicator Light

5. Tachometer (optional)

6. Air Pressure Gage (front)

7. Low Air Indicator Light

8. Fuel Gage

9. Digging Brake Indicator Light

10. Oil Pressure Gage

11. Coolant Temperature Gage

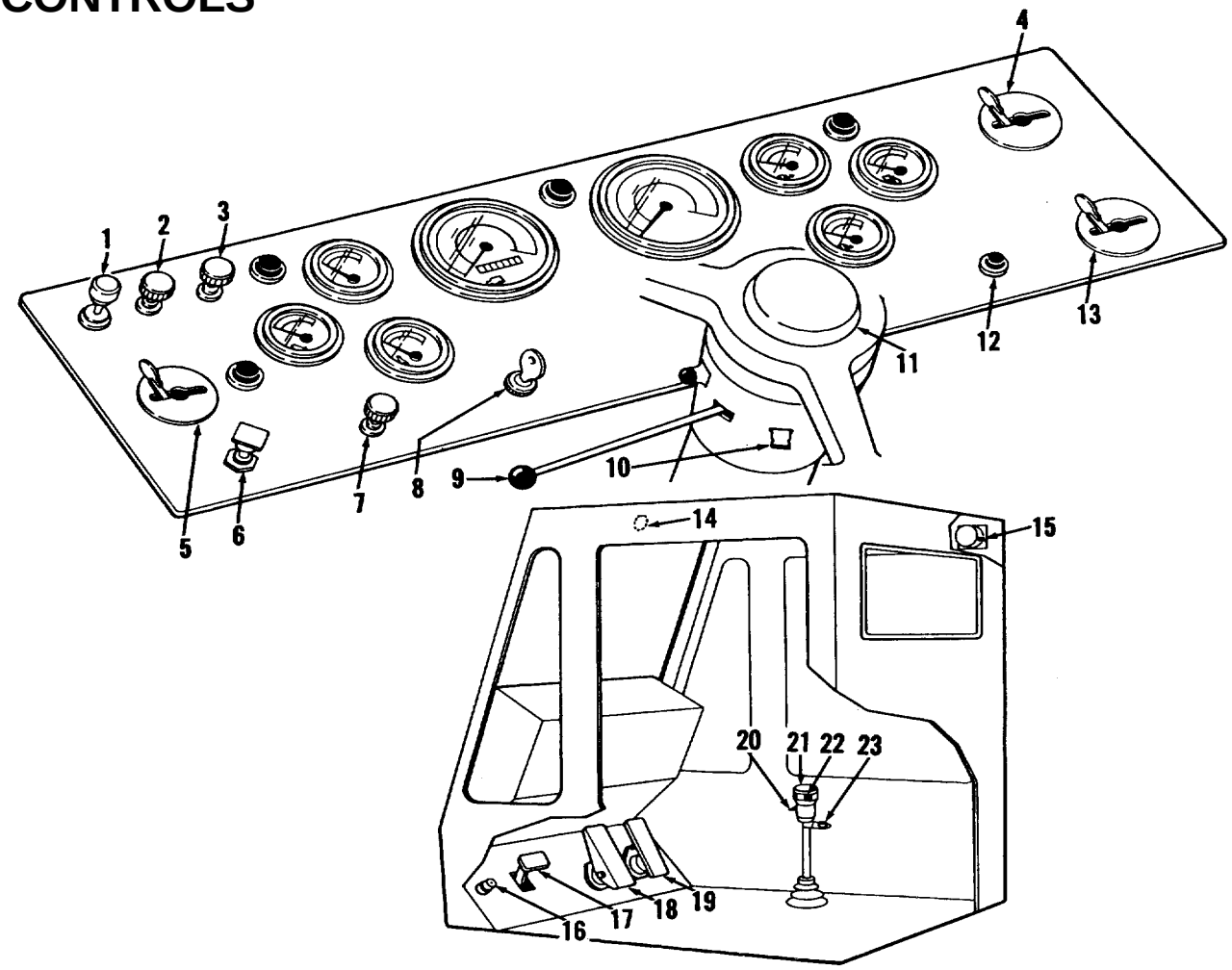
12. Turn Signal/Hazard Indicator Light

13. Air Pressure Gage (Rear)

WARNING

Do not move carrier while low air light is glowing or while any auxiliary device is signaling a dangerous condition.

CONTROLS



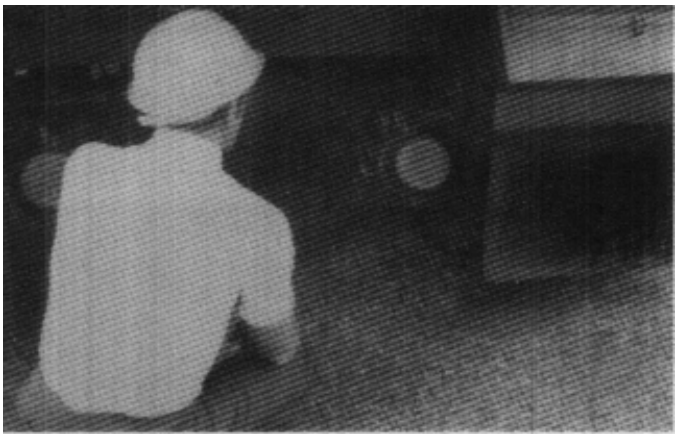
1. Heat Control Knob
2. Heater Fan Switch
3. Defroster Fan Switch
4. Front Wheel Drive Toggle (6x6 only)
5. Digging Brake Toggle
6. Parking Brake Knob
7. Light Switch
8. Ignition Switch
9. Turn Signal Lever
10. Hazard Flasher Switch
11. Horn Button
12. Windshield Washer Button
13. Interaxle Differential Toggle
14. Windshield Wiper Valve
15. Dome Light Switch
16. High/Low Beam Switch
17. Clutch Pedal
18. Brake Valve Pedal
19. Accelerator Pedal
20. Range Preselection Lever
21. Gear Shift Lever
22. Deep Reduction Button
23. Clutch Brake Button

CHECKS AND SERVICES
BEFORE STARTING ENGINE

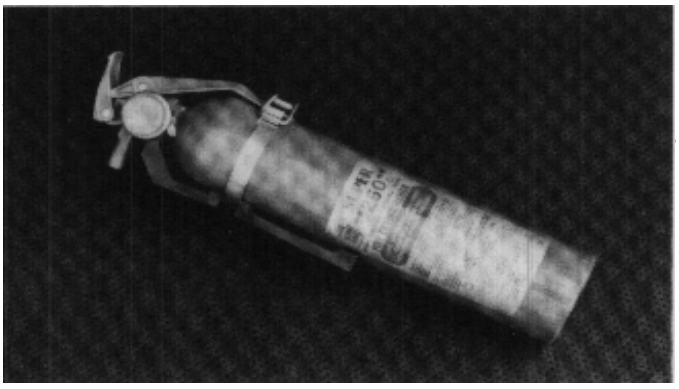
Complete all required maintenance before driving the carrier

⚠ WARNING

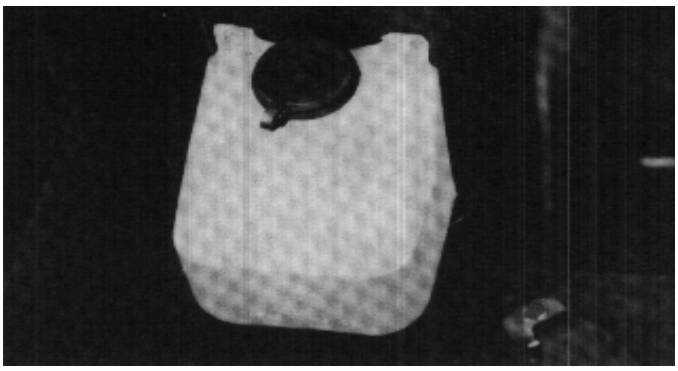
Use extreme caution when checking items beyond your normal reach. Use an approved safety ladder.



Inspect carrier for obvious damage, vandalism and needed maintenance. Check for signs of fuel, lubricant, coolant and hydraulic leaks. Open access doors and look for loose fittings, clamps, components and attaching hardware. **Check brake and steering systems** for obvious damage. **Check operation** of all lights and repair as necessary before operating. Broken windows must be replaced before operating. If spark arrestors are used, be sure they are in place and in good working order.

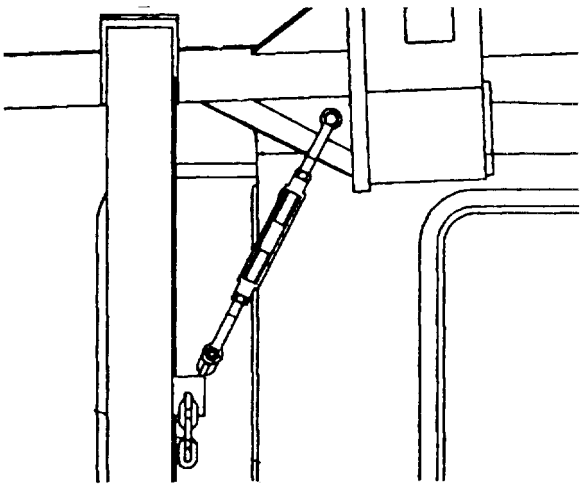


Check for fully charged **fire extinguisher** on rear wall in carrier cab. Be sure to read and understand instructions on extinguisher. Replace extinguisher as necessary.

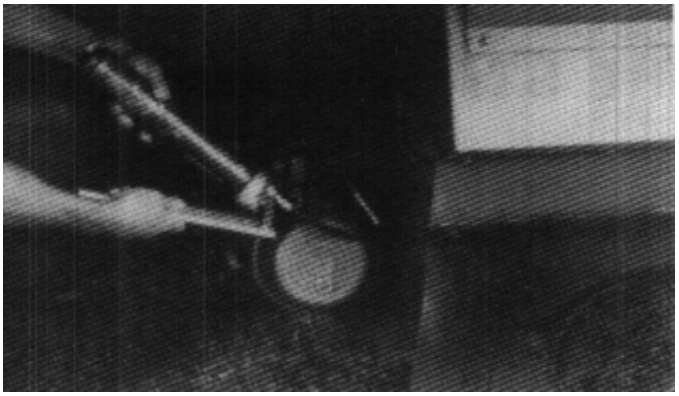


Check fluid level in **windshield washer r**eservoir on rear wall in carrier cab. Add windshield washrsolvent as necessary.

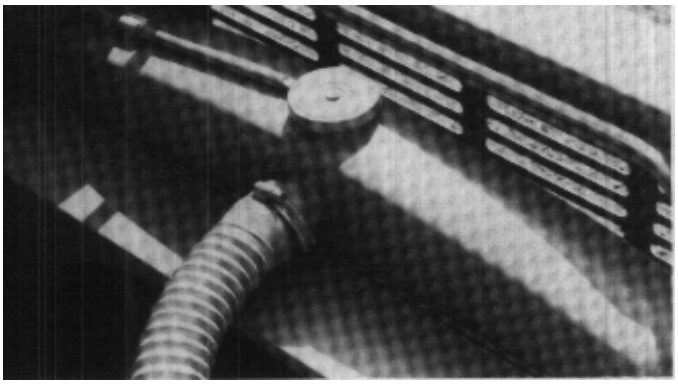
Check position of **DIGGING BRAKE** toggle. Toggle should be in OFF position for operation from carrier cab. Be sure parking brake is applied before moving toggle to OFF position.



Check for **secure stowage** of boom and any auxiliary equipment or material.



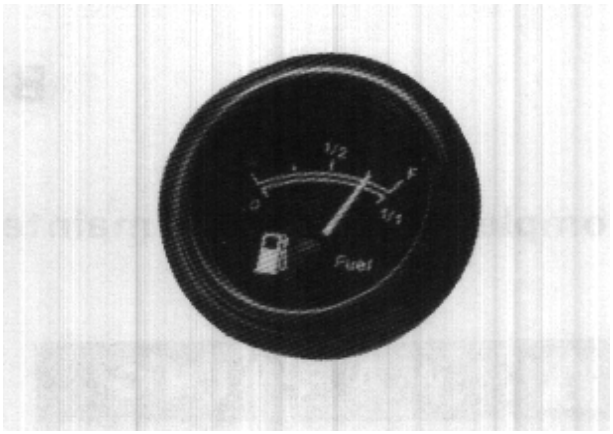
Lubricate unit as indicated on lubrication chart.



Check engine coolant level and replenish as necessary. Be sure anti-freeze solution is adequate for expected temperatures. Be sure radiator fins are clean.

⚠ WARNING

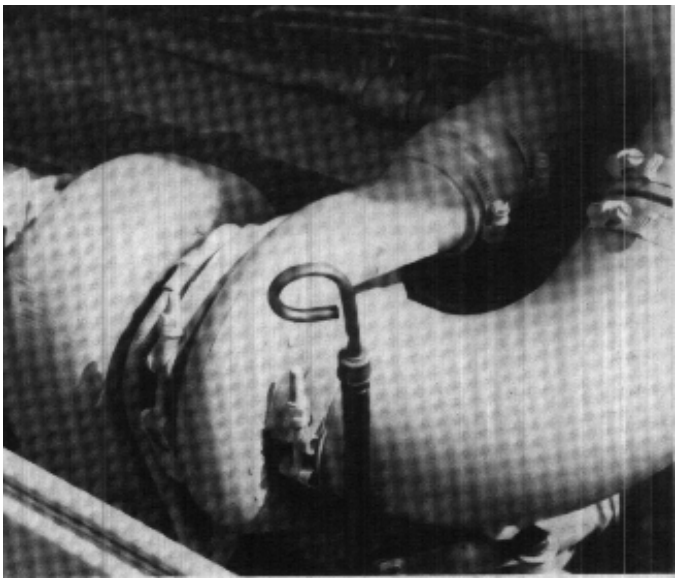
If it is necessary to check the coolant level in a hot radiator, shut off the engine and relieve pressure before removing the radiator cap. Relieve pressure by holding the cap with rags and turning to the left till pressure begins to escape. Wait a few minutes till sound of escaping pressure stops and remove cap cautiously.



Check fuel level and replenish as necessary. Refuel at the end of the work shift to minimize condensation.

⚠ WARNING

Engine should be turned off while refueling. Be sure area is free of open flame, sparks or any condition which could cause fuel to ignite.



Check oil level in engine crankcase and replenish as necessary. DO NOT OVERFILL.

NOTE: If engine is being started at beginning of work shift be sure to perform all "CHECKS AND SERVICES BEFORE STARTING ENGINE

Starting Diesel Engine (Cummins)

1. Be sure transmission is in neutral and parking brake is applied.
2. Turn ignition switch to ON position.
3. Depress accelator pedal fully and then release pedal.

⚠ CAUTION

Do not engage starting motor while fly-wheel or starting motor is rotating. Serious damage could result

4. Turn ignition switch fully clockwise to engage starting motor. Release key immediately when engine starts. If engine fails to start within fifteen seconds, release key and allow starting motor tocool for a few minutes before trying again.

NOTE: It may be necessary to use a cold weather starting aid in temperatures below freezing.

5. After engine starts, observe oil pressure gage. If gage remains on zero for more than 15 seconds, stop engine and determine cause. Correct before restarting engine.
6. Warm up engine at approximately 1000 RPM until coolant temperature reaches operating range (approximately 140°F/60°C)

Cold weather starting aids

Diesel engine ignition is accomplished by heat generated when fuel/air mixture is compressed within the cylinders. Because this heat may be insufficient to start a cold engine in cold weather, the use of starting aids has become common practice.

Because of the wide variety of starting aids available it would be impractical to attempt to provide specific instructions for their use in this manual. Carefully follow instructions furnished with your starting aid.

If you use a starting aid employing ether or a similar substance pay particular attention to manufacturer's warnings.

WARNING

DO NOT use ether starting aid if air system is equipped with an alcohol moisture evap-orator.

Normal engine operation (Cummins)

Observe voltmeter water temperature and oil pressure **gages frequently to be sure all engine systems are functioning properly.**

Be alert for unusual noises or vibration. When an unusual condition is noticed stop in a safe area and shut off engine. Determine cause and correct before continuing.

Early recognition and correction of unusual conditions can often prevent a major breakdown.

Apply load to engine gradually; shock loads are hard on all drive line components.

When using engine breaking power (downshifting or releasing accelerator and permitting carrier to "push" engine) to slow travel take care to avoid **overspeeding the engine** (exceeding governed RPM -2200 RPM). The governor has no control over engine speed when engine is being "pushed" by carrier load.

Select an appropriate gear ratio and use service brake to assist in slowing travel down steep grades.

Permitting the engine to labor under too great a load for the gear ratio being used (lugging the engine) will shorten engine life. **Shift to the proper gear ratio for conditions.**

Avoid prolonged idling. Idling causes engine temperature to drop and this permits formation of heavy carbon deposits and dilution of lubricating oil by incompletely burned fuel. If the engine is not being used turn it off.

Stopping the engine (Cummins)

Operate engine at idle speed for a few minutes before turning it off. This allows engine coolant and lubricating oil to carry excessive heat away from critical engine areas. This is especially important for turbo charged engines

Do not "gun" engine before shut down; this practice causes raw fuel to remove oil film from cylinder walls and dilute lubricant in crankcase. Stop engine by turning ignition switch to "OFF" position.

CHECKS AFTER STARTING ENGINE

(To be performed at beginning of each work shift)

Complete all required maintenance before driving

1. Check operation of **windshield washer and wiper.**

2. Check all l**ights and turn signals** for proper operation.

3. Check operation of **heater and defroster**.

4. Observe oil **pressure gage** with engine running at operating temperature and speed. Minimum oil pressure is 10 to 30 psi (69 to 207 kPa).

   Observe **voltmeter** indication of alternator output. Proper output is approximately 14 V. with engine running at 2000 RPM.

6. Observe **water temperature gage**. Proper operating temperature is approximately 140/200°F. (60/93 °C).

7. Observe **tachometer** response to changes in engine speed.

8. Observe **low air warning light.** Light should continue to glow until brake system pressure reaches approximately 60 psi (414 kPa). Do not release parking brake or move carrier while low air warning light is still glowing.

9. Observe **air pressure gages.** Proper brake system pressure is 60/125 psi (414/862 kPa)

CHECKS BEFORE DRIVING

(To be performed at beginning of each work shift)

Complete all required maintenance before driving.

1. Check operation of brakes by performing the following procedure:

   a. Position unit on level surface and apply digging brake.

   b. Position boom over rear of chassis and imbed bucket in ground or against a solid object.

   c. Apply down pressure with boom and pull and push with boom while helper watches for rotation of each wheel.

   d. Rotation of any wheel during step c. indicates brake failure on that wheel. Have any failure corrected before driving the unit.

2. Check operation of steering while moving slowly in first gear. Be alert for any increase in effort needed to turn wheels and any unusual steering response to normal steering effort.

3. Check operation of horn and travel and back-upalarm and any other signal devices

PLAN YOUR TRIP

1. Plan a safe route to your destination.
2. Ask your supervisor about permit requirements.
   Check on load & clearance limits along your route.
3. Dimensions for your unit are shown below:
   Height - varies depending on attachment - measure unit to be sur
   Width .....8' (2.44 m)
   Ground Clearance .....10" (254 mm)
   Weight - varies depending on options - weigh unit to be sure.

BRAKE SYSTEM

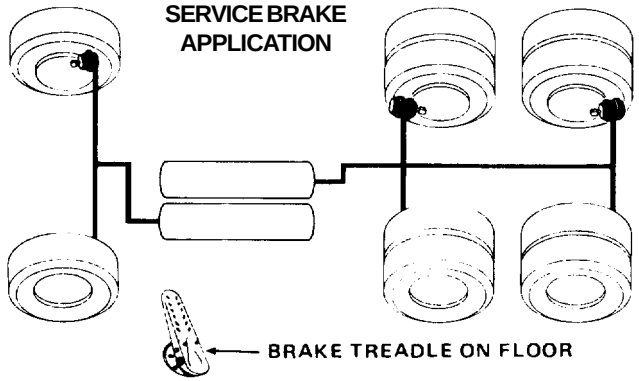
The air brake system includes a service brake, an emergency brake, a parking brake and a digging brake.

WARNING

Wear safety belt to avoid-being thrown from driver's seat during braking emergency.

NOTE: Lines in following simplified brake system diagrams show pressure and exhaust air flow under various system conditions.

Service brake



The basic system includes two reservoirs to store and furnish air pressure for service brake operation. One reservoir supplies pressure to apply brakes to the wheels of the front axle and the other supplies pressure to apply brakes to the wheels of the forward and rear tandem axles. Depressing the brake treadle causes air pressure to be applied to brake actuators of all wheels simultaneously.

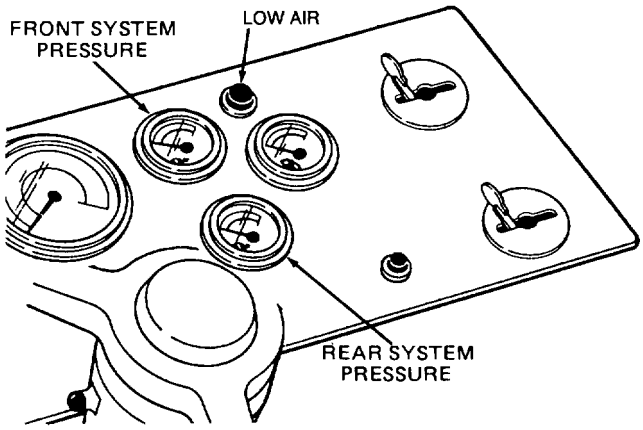
WARNING

Do not "fan" the brake valve treadle. A longseries of rapid brake applications can reduce system pressure to a point where effective service braking will be lost until air compressor can restore pressure.

The operating pressure range for service brakes is 60 to 125 psi (414/862 kPa). Two pressure gages are furnished to indicate pressure in front and rear portions of the system. The gage on top indicates pressure available for front axle brakes and the gage on the bottom indicates pressure available for tandem axle brakes. If pressure in either portion of the system falls below safe operating range, the low air indicator light will flash.

WARNING

Do not drive while low air indicator is flashing. If light comes on while carrier is moving, stop carrier in a safe area as soon as possible. If carrier will not maintain proper brake pressure notify maintenance personnel immediately for repair of condition.

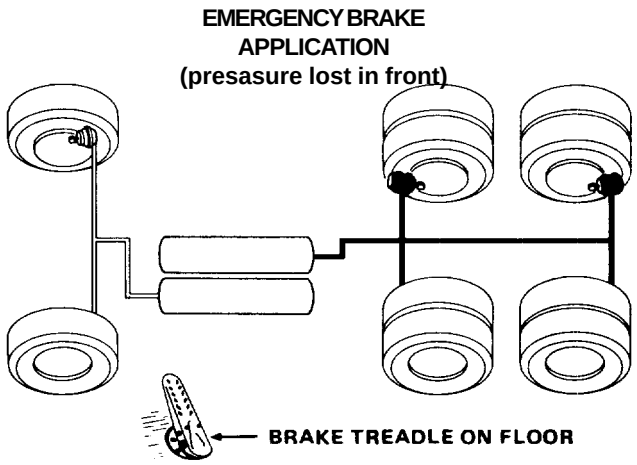


Emergency brake

The emergency brake functions only when air pressure has been lost from some portion of the dual brake system. Emergency brakes are applied by normal foot pressure on the brake treadle.

WARNING

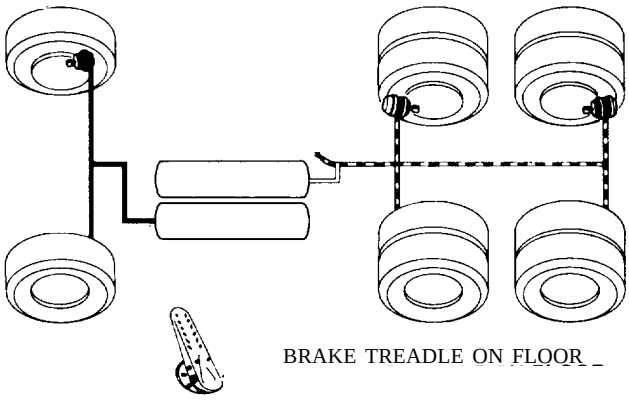
Emergency brakes will not stop carrier in as short a distance as the service brakes.



If air pressure is lost from the front portion of the dual brake system, normal actuation of the brake

treadle valve will apply service brakes to the wheels of the forward and rear tandem axles. There will be no braking on the wheels of the front axle.

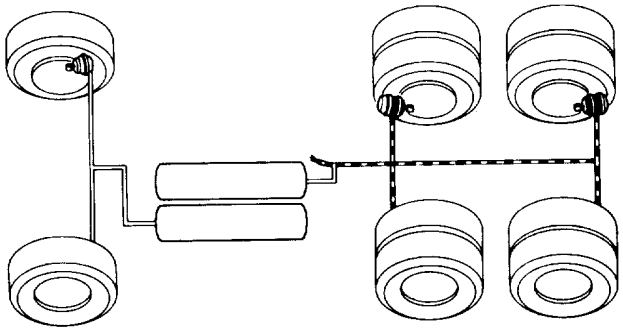
EMERGENCY BRAKE APPLICATION (pressure lost in rear)



If air pressure is lost from the rear portion of the dual brake system, normal actuation of the brake treadle will apply service brakes to the wheels of the front axle and cause a controlled application of spring brakes to the wheels of the forward and rear tandem axles.

After pressure is lost from one portion of the dual brake system, there may only be enough pressure in the other portion for one or two emergency brake applications. When the available pressure has been used the spring brakes will apply automatically.

EMERGENCY BRAKE APPLICATION (pressure lost in front and rear)



AUTOMATIC

In the event air pressure is lost from both front and rear portions of the system there will be an automatic application of the spring brakes. They will begin to apply as pressure drops to 60 p.s.i. (414 kPa) and there will be a complete application when pressure decreases to 40 p.s.i. (276 kPa).

Because air pressure is required to release spring brakes, an automatic application will remain ON until air pressure can be restored

If the air pressure gages indicate some system pressure remaining, it may be possible to drive the unit a short distance to remove it from a hazardous position (hold parking brake knob in depressed position and use LL1 gear range).

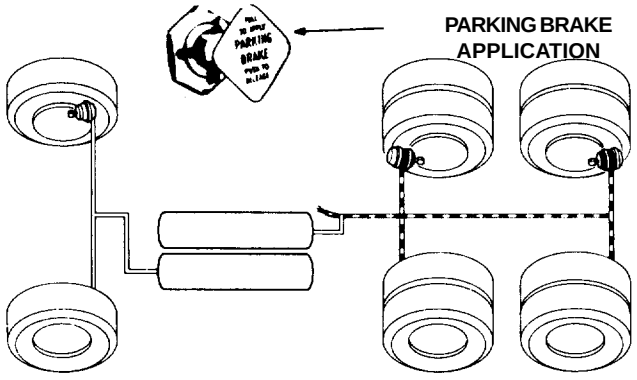
If carrier cannot be moved, direct traffic around carrier until warning flags, flares or lights can be displayed. Notify proper authorities and maintenance personnel as soon as possible.

Parking brake

Apply parking brake by raising parking brake control knob. This causes air pressure to be vented from spring chambers allowing springs to apply brakes to wheels of forward and rear tandem axles. Knob will raise automatically if air pressure is lost from front and rear portions of system.

PARKING BRAKE BUTTON ON DASH

PARKING BRAKE APPLICATION



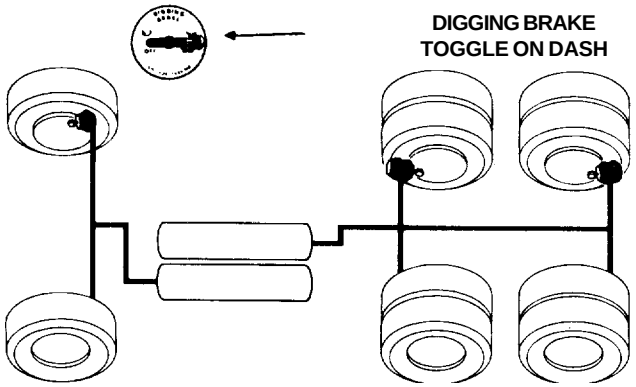
Release parking brake by depressing parking brake control knob (system must be pressurized to release parking brake).

Digging brake

Digging brakes are furnished on units equipped only for conventional control as well as on units equipped for both conventional and remote control. When activated, the digging brake is applied to all wheels to hold the carrier stationary while the excavator is digging.

Air pressure requirements for digging brake application are not the same as those for the service brake (60 to 85 p.s.i. - 414 to 586 kPa). If pressure is lost after the digging brake has been applied, emergency brakes will be applied automatically.

DIGGING BRAKE APPLICATION



WARNING

Move digging brake control toggle to ON position only when carrier is stopped. Maximum braking is applied to wheels when toggle is moved to ON.

Moving toggle to ON while traveling would also cause disengagement of clutch and engagement of remote drive power take-off.

Apply digging brake by moving control toggle to ON position and release by moving toggle to OFF position.

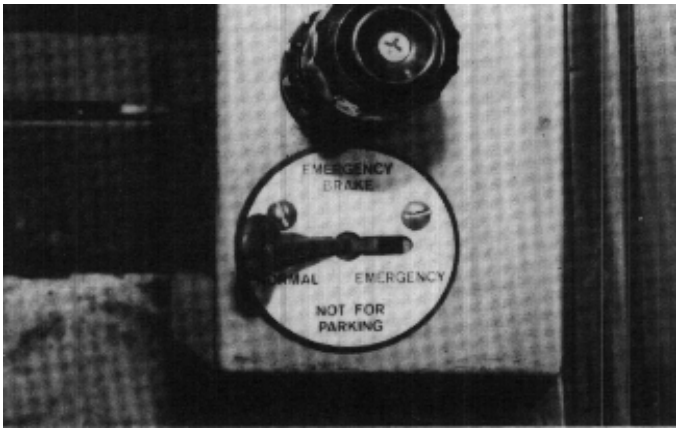
The DIGGING BRAKE indicator light will flash on and off when digging brake is applied and ignition switch is turned on.

Remote control braking

The digging brake is applied by the control toggle in the carrier cab. After moving digging brake control toggle to ON, the digging brake will be released and reapplied automatically as travel pedal in upperstructure is actuated and released.

WARNING

Allow sufficient time for full brake system pressure (125 p.s.i.-862 kPa) to be developed in upperstructure before operating unit in remote control.



Units equipped for remote control have an emergency brake control **located in the upperstructure cab.** This control is to be used in case of failure of the automatic digging brake.

If digging brake fails to apply when travel pedal is released, move emergency brake toggle to apply emergency brake. Notify maintenance personnel immediately for repair of digging brakes.

Apply upperstructure emergency brake when leaving upperstructure cab.

See pages 29 and 30 for detailed instructions on remote control operation.

Air Drier

An air drier is furnished to remove moisture and contaminants from air as it is delivered from compressor to first air reservoir. The drier includes a heating element to prevent freezing.

During compressor unloading, moisture and contaminants are purged from drier to atmosphere.

Under certain temperature conditions, condensation may cause a small amount of water to accumulate in system. Check air reservoirs monthly for moisture accumulation.

The air drier desiccant cartridge should be serviced or replaced annually unless experience indicates a shorter or longer interval. Refer to brake section of service manual for air drier maintenance instructions.

Conventional steering

The power steering system provides low effort steering under normal conditions and greater control in the event of a blowout or soft ground. “Road feel” is similar to that of a conventional manual steering system.

⚠ CAUTION

Use of power steering while carrier is stopped causes unnecessary stress on system components and can cause serious damage to system.

Holding steering wheel in full left turn or full right turn position will cause system to overheat. This can cause steering pump to fail.

Remote control steering

Your unit is equipped with a steering pedal in the upperstructure cab. Upperstructure engine must be running to provide power for remote control steering.

Regardless of upperstructure position on carrier, moving pedal to left turns wheels to left; moving joystick to right turns wheels to right.

When not held in a left or right steering position, the steering pedal will return automatically to its neutral (non-steering) position. Be sure upperstructure cab is kept free of equipment and foreign material which could jam steering pedal in a steering position.

Rotation of steering wheel will occur during remote operation. KEEP CLEAR!

⚠ WARNING

Be alert for any increase in effort needed to steer. If any difference is noted, notify maintenance personnel immediately for correction. If power assist feature should fail for any reason IT WOULD BECOME VERY DIFFICULT TO STEER. For this reason it is extremely important that you NEVER TURN ENGINE OFF WHILE TRAVELING.

In the event power steering fails, stop as soon as possible. Do not drive unit until problem has been corrected.

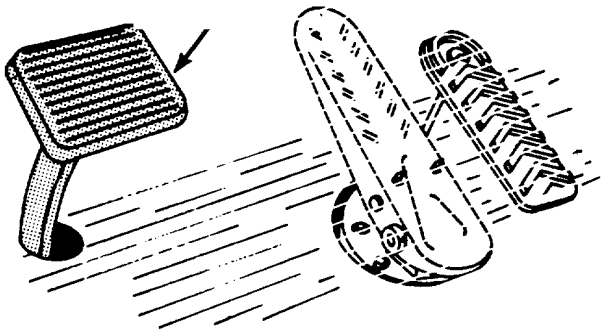
POWER TRAIN

The power train furnished on 6x4 carriers (units having two driving axles at rear) includes the engine, clutch, transmission, rear tandem axles and the necessary propeller shafts to transfer torque (power) between these units.

The major variations found on 6x6 carriers (units having two driving axles at rear and a third driving axle in front) are the substitution of a front driving axle in place of a non-driving front axle and the addition of a transfer case to drive front axle.

Clutch

CLUTCH



The clutch is located within a housing between the engine and transmission and functions to control the transfer of torque from engine to transmission.

Depressing the clutch pedal disengages the clutch and prevents a transfer of torque from the engine to the transmission. Releasing the clutch pedal engages the clutch and causes a transfer of torque from the engine to the transmission.

Clutch Brake

The clutch brake slows rotation of transmission input gearing. Its only purpose is to ease the shift from neutral to 1st or reverse gear while the carrier is stopped.

The clutch brake is controlled by the clutch brake button (mounted on the rear side of the gear shift lever). Depress button to apply brake and release button to release brake.

DO NOT use clutch brake when downshifting.

Transfer Case (for 6x6 units only)

The transfer case is a gearbox located between the transmission and rear tandem axles. It functions with the transmission to transmit torque (power) to the front and rear driving axles.

Front axle drive is controlled by the front wheel drive toggle located on the dashboard.

⚠ CAUTION

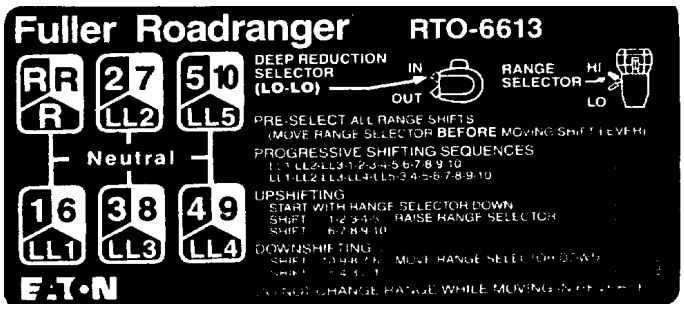
Do not engage front axle drive while carrier is moving. Stop carrier before shifting.

Transmission

The transmission is a gearbox which transmits torque from the engine as it is delivered to move the carrier. The transmission in your carrier provides 13 forward speeds and 3 reverse speeds.

The lowest transmission gear range (LL 1) provides the greatest carrier power and the lowest carrier speed. The highest transmission gear range (tenth gear) provides the greatest carrier speed with the least carrier power. Gear selections between these gear ranges provide power/speed combinations between these extremes. Reverse gears provide approximately the same power/speed ratios as LL1, 1st gear and 6th gear.

NOTE: Study the shift pattern decal and you will see that it would be possible to shift to fifteen forward speeds rather than the stated thirteen speeds. However, LL4 provides the same reduction as 1st gear and LL5 provides the same reduction as 2nd gear. Using either of the suggested progressive shift sequences on the decal provides thirteen forward speeds.



SHIFTING GEARS

Smooth, efficient gear shifting depends on coordinated use of accelerator pedal, clutch pedal, range preselection lever, deep reduction button and shift lever. It is also important that shifting occur at the proper time with respect to carrier power requirements and engine speed.

For those unfamiliar with a manual transmission it may seem that gear shifting is a complicated procedure. A practice period with the carrier parked and the engine turned off will help develop the necessary coordination and confidence. There should be little difficulty if shifting procedures are followed step by step.

When practicing with the engine turned off there will be areas in the shift pattern where you will be unable to make a complete engagement. Don't use excessive force, just learn the pattern.

When to shift gears

Smooth, timely shifting not only increases carrier service life, it provides greater driving safety.

In lower gears use only enough engine speed to get the carrier rolling easily. High engine speeds under light load conditions waste fuel and cause excessive and unnecessary noise. Use a little more engine speed for each successive upshift until reaching desired cruising speed.

Unless starting from a standstill on an uphill grade, or in off-road use, it is unnecessary to use LO-LO range.

When load conditions cause a continuing loss of engine speed, downshift to the next lower gear. In general, operate in a gear that will permit acceleration.

Though it is permissible to use the braking power of the engine when traveling downhill, take care to avoid overspeeding the engine (exceeding governed RPM). The governor has no control over engine speed when the engine is being pushed by the carrier load. Select an appropriate gear ratio and use your brakes to assist in slowing the carrier.

Use LL1, LL2 or LL3 for off-road conditions. First gear may be used off-road only if surface is hard and level.

⚠ WARNING

Stop carrier and select appropriate gear range before driving down steep grade under "off highway" conditions. Attempting to downshift under these conditions can be dangerous.

Double-Clutching

Gears in the main transmission are not synchronized and double clutching procedure must be used when shifting.

Double-clutching is a procedure for adjusting the speed of one transmission gear shaft (driven by the engine) to a second transmission gear shaft (driven by carrier drive wheels) to prevent clashing when gears on these shafts mesh.

This is accomplished by using the engine to increase or decrease the speed of the engine-driven gear shaft.

Two double-clutching procedures are given, one for upshifting and one for downshifting. Be sure to use each at the proper time. Using the wrong procedure will cause gears to clash.

NOTES: The following double-clutching procedures apply to shifts within a gear range (LO-LO, LO or HI). Additional steps are required when shifting from one range to another. These steps will be explained under Upshifting and Downshifting headings. Although double-clutching procedures are broken down into separate steps, the actual performance of these steps should be rapid and smooth.

Double-Clutching for Upshift

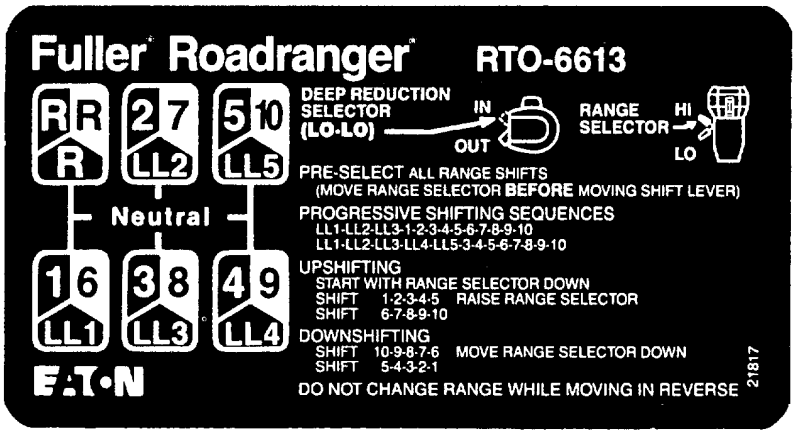
1. Release accelerator pedal and depress clutch pedal.
2. Move gear shift lever to neutral and release clutch pedal.
3. When engine speed nears low idle, depress clutch and shift to next higher gear. If shift timing has been correct, gears will mesh smoothly with no clash.
4. Release clutch evenly while depressing accelerator to apply power smoothly.

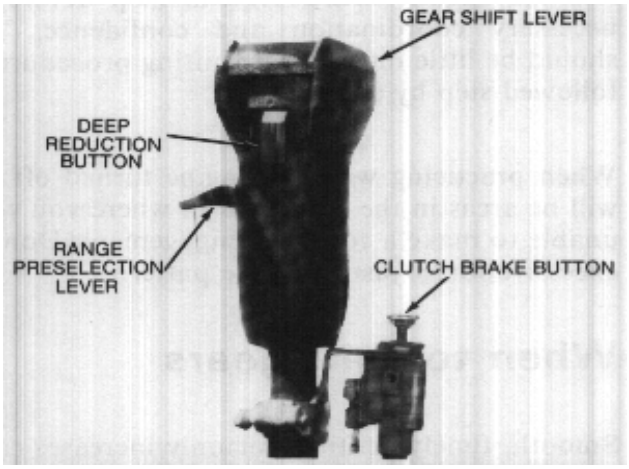
Double-Clutching for Downshift

NOTE: Downshifting is used to aid in reducing carrier speed or to increase carrier power.

1. Release accelerator pedal and depress clutch pedal.
2. Move gear shift lever to neutral and release clutch pedal.
3. Depress accelerator pedal to increase engine speed to high idle, depress clutch and shift to next lower gear. If shift timing has been correct, gears will mesh smoothly with no clash.
4. Release clutch evenly and depress accelerator as appropriate for conditions.

Upshifting





Precautions

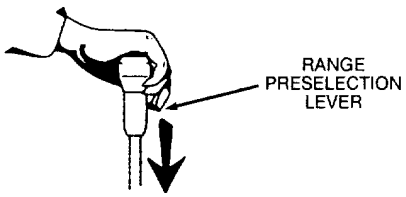
- **For a smooth start, select a starting gear that will provide sufficient reduction for the load and terrain.**
- **Always use normal double-clutching procedures when making lever shifts.**
- **Never slam or jerk the shift lever to complete gear engagement.**
- **Never coast with the gear shift lever in neutral.**
- **Never make a range shift when in reverse. Never downshift at too high of a road speed.**
- **Never move the Deep Reduction Button or the Range Preselection Lever with the gear shift lever in neutral while vehicle is moving.**

1. With parking brake applied, depress clutch and move gear shift lever to neutral.
2. Start engine and wait till carrier air system reaches 125 psi (862 kPa).
3. Release parking brake and hold carrier in position using service brake.

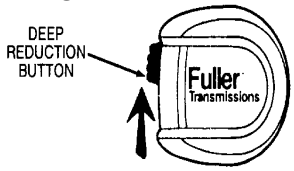
⚠ CAUTION

NEVER move range preselection lever of deep reduction button while carrier is moving and transmission is in neutral. When carrier is moving, these controls MUST be moved to desired position while carrier is in gear, BEFORE disengaging clutch and shifting to neutral for next shift.

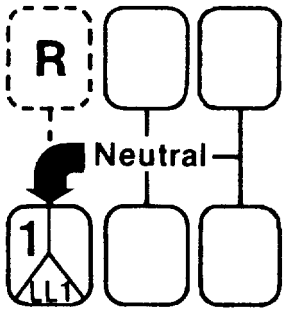
4. Move range preselection lever down to LO range position



5. **If conditions require starting in LO-LO range:**
   a. Move deep reduction button forward to select deep reduction range.



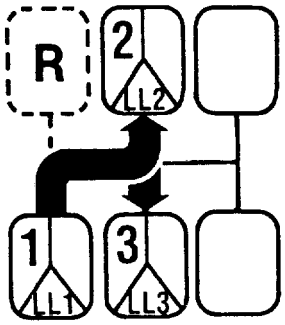
b. Depress clutch pedal, depress clutch brake button and move shift lever to LL1 gear position.



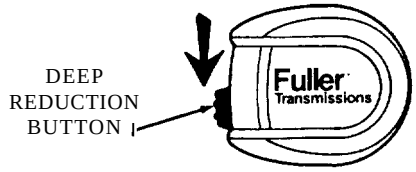
c. Release clutch brake button.

d. Release clutch pedal evenly while depressing accelerator pedal smoothly. Carrier will move forward in LL1 gear.

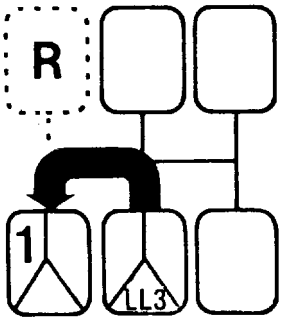
e. Use upshift - double-clutching method to shift thru LL2 gear to LL3 gear.



f. When ready to shift to next higher gear (1st gear) move deep reduction button to rear to LO Range position.



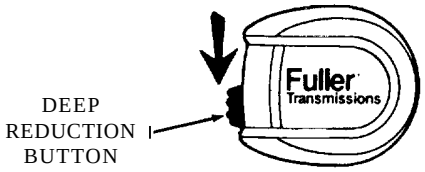
g. Using upshift-double-clutch method shift to 1st gear position - BUT - do not release clutch to engage 1st gear (see note).



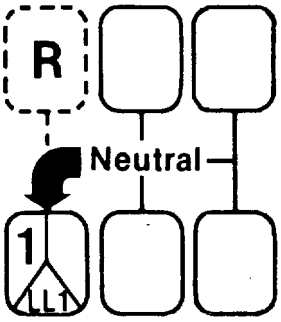
OR

If conditions permit starting in LO range:

A. Move deep reduction button to rear to select LO range.



B. Depress clutch pedal, depress clutch brake button and move shift lever to 1st gear position.

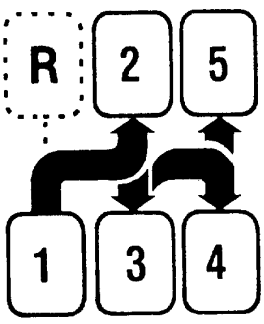


C. Release clutch brake button - BUT - do not release clutch to engage 1st gear (see note).

NOTE: If starting in LO-LO range (a. thru g. of step 5) carrier will be moving. If starting in LO range (A. thru C. of step 5) carrier will not be moving. Otherwise, transmission and clutch will be in same condition: ready to release clutch to engage 1st gear. Proceed with step 6.

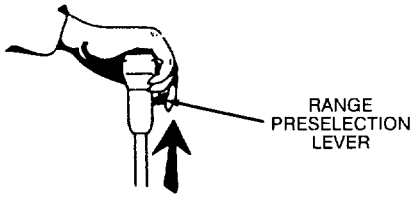
6. Immediately release clutch evenly while depressing accelerator smoothly to engage 1st gear.

7. Using upshift - double-clutching method, shift from 1st gear thru 2nd, 3rd and 4th gears to 5th gear.

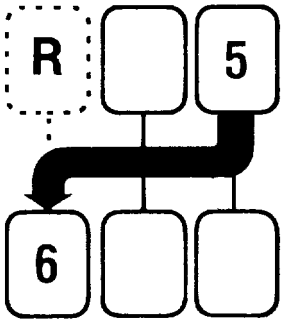


LEVER

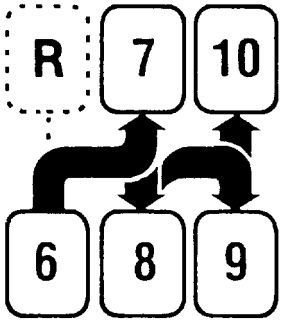
When ready, move range preselection lever up to HI position.



Using upshift - double-clutching method, immediately shift from 5th gear position to 6th gear position.



As conditions permit, use upshift - double-clutching method to shift thru 7th, 8th and 9th gears to 10th gear.



Downshifting

During normal driving there are times when it is necessary to downshift (shift from one gear or range to the next lower gear or range) to decrease carrier speed or increase carrier power.

NOTE: The following procedure assumes that carrier is traveling in 10th gear. However, this procedure will apply to downshifting from lower gears. Follow procedure from appropriate gear. This procedure covers downshifting from 10th gear to LL1. Unless traveling a very steep upgrade it shouldn't be necessary to downshift thru the entire range of gears; use that portion of procedure which applies to your conditions.

⚠ CAUTION

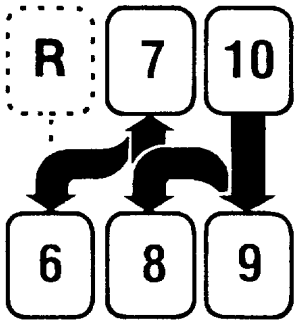
Never downshift when carrier speed will cause engine to overspeed in next lower gear or serious damage to engine may result. Use service brake to slow carrier to proper speed for downshift it necessary.

MAXIMUM CARRIER SPEED IN EACH GEAR

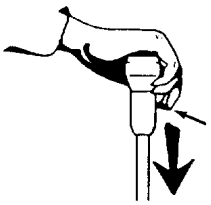
RANGE	GEAR	MI/HR	KM/HR
LO-LO	LL1	3	4.8
	LL2	4	6.4
	LL3	5	8.1
LO	1	6	9.7
	2	8	12.9
	3	10	16.1
	4	13	20.9
	5	17	27.4
HI	6	21	33.8
	7	27	43.5
	8	34	54.7
	9	44	70.8
	10	54	86.9

NOTE: Gears in the main transmission are not synchronized and double-clutching procedure must be used when shifting.

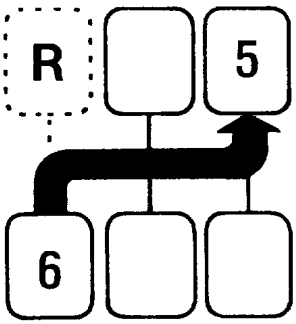
1. Using downshift - double-clutching method, shift thru 9th, 8th and 7th gears to 6th gear.



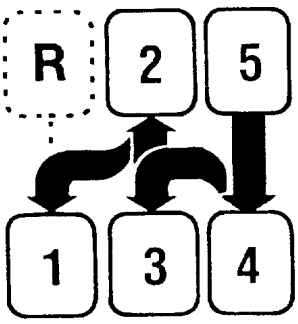
2. While still in 6th gear, push range preselection lever down to LO range position.



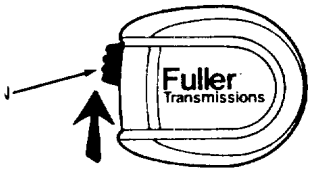
3. Using downshift - double-clutching method immediately shift to 5th gear. Transmission will shift to LO range as shift lever passes thru neutral.



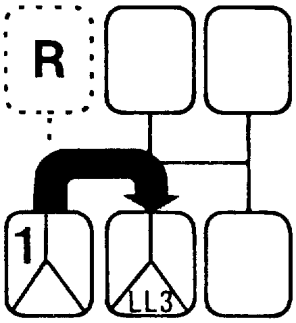
4. Continue downshifting thru 4th, 3rd and 2nd gears to 1st gear using downshifting - double-clutching method.



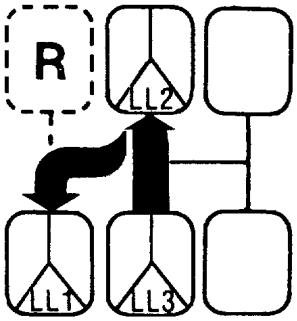
5. If it is necessary to shift to deep reduction, move deep reduction button forward to LO-LO position.



6. Immediately shift to LL3 using downshift - double-clutching method.

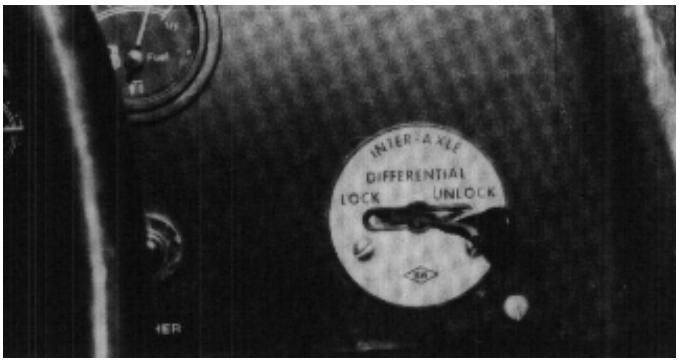


7. Continue to use downshift - double-clutching method to shift to LL2 and LL1.



INTER-AXLE DIFFERENTIAL

An inter-axle differential is provided at the rear of the front tandem axle. This unit divides input torque equally between the front and rear tandem axles.



The inter-axle is controlled by a toggle lever mounted at the lower right portion of the dashboard.

With toggle in UNLOCK position, the front and rear tandem axles are permitted to rotate at different speeds to compensate for worn tires on one of the axles. Keep toggle in UNLOCK position when driving on good tractive conditions.

With toggle in LOCK position, there is positive drive to the front and rear tandem axles and either axle will drive up to its maximum tractive ability without regard to the other axle. Keep toggle in LOCK position when driving over poor tractive conditions (mud, ice, snow or off-road travel). Also use lock position for remote control travel.

The inter-axle differential may be locked when traveling **BUT NEVER** when wheels have lost traction and are spinning.

⚠ CAUTION

Serious damage will occur if inter-axle differential is shifted while wheels are spinning.

If shifting inter-axle differential while traveling, release accelerator first to provide an interruption in torque to the axles

KEEP CARRIER IN GEAR WHILE DRIVING; COASTING IS DANGEROUS AND MAY CAUSE SERIOUS DAMAGE TO TRANSMISSION.

NOTE: Remote control is to be used for positioning unit at job site, not for over-the-road travel.

Preparing Carrier for Remote Control Operation

1. With carrier on level surface, apply parking brake.

2. Start carrier engine and develop full brake system pressure in front and rear portions of system (125 psi/862 kPa.)

3. With engine running, depress clutch and shift transmission to LL1,LL2 or LL3 gear range (LL4 may be used only on hard level surface). When sure of complete engagement, stop engine and release clutch.

WARNING

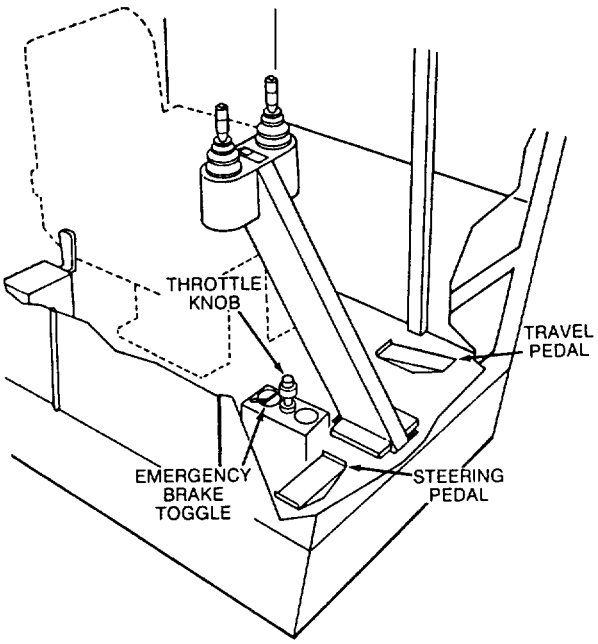
Be sure to keep feet clear of clutch pedal when moving DIGGING BRAKE toggle to ON position (step 4).

4. Move DIGGING BRAKE toggle to ON position. This applies digging brake, disengages carrier engine clutch and engages remote drive power take-off.

5. Release parking brake. Move inter-axle differential toggle to LOCK position for off-road conditions.

Preparing Upperstructure for Remote Control Operation

REMOTE CONTROLS IN UPPERSTRUCTURE



1. Be sure controls in carrier cab have been properly set for remote control operation (above).

2. Be sure joystick and foot pedal controls are in neutral position.

NOTE: Disengage engine clutch for easier starting in cola weather (if so equipped). After starting, engage clutch with engine stopped to reduce shock load on hydraulic pump shaft.

3. Start upperstructure engine and develop full brake system pressure (125 psi/862 kPa).

4. Be sure engine clutch is engaged.

5. With emergency brake applied, perform following procedure to be sure power take-off is fully engaged.

a. Adjust upperstructure engine speed to idle and move variable flow control lever to high (full flow) (if so equipped).

b. Very gently engage travel pedal to cause a slight rotation of power take-off gear.

c. If step b caused gears to clash, power take-off was not engaged. Repeat step b.

If step b caused engine to reduce speed, power take-off is fully engaged. Move variable flow control lever to desired mode and **increase engine speed to full throttle fouppersructure operation.**

6. Move EMERGENCY BRAKE control to NORMAL position.

Precautions for Remote Control Operation

Be sure of clear visibility in direction of travel; use a signalman to compensate for blind spots.

Be sure all Warm-Up and Operational Checks have been performed.

Be sure of clear path for carrier, boom and counterweight before starting to move. Be especially watchful for people, overhead wires and traffic.

Never tow load using remote control drive.

Always give audible signal before moving unit

Never permit bucket to drag while moving unit.

Rotation of steering wheel will occur during remote operation. KEEP CLEAR!

Be sure travel alarm function properly.

Over the side stability is reduced during remot travel because front axle lock cylinders automatically unlock when traveling.

Driving carrier from upperstructure cab

⚠ WARNING

Avoid confusion! Before actuating remote control steering and travel pedals, think about the direction you are facing with respect to the direction the carrier is facing. Confusion could cause you to travel in the direction opposite that expected.

1. Be sure controls in carrier and upperstructure cabs have been properly set for remote control Operation (see previous page).

2. Be sure engine is running at full throttle. Carrier speed is controlled by gear selection and amount of pedal actuation.

3. Travel pedal controls forward and reverse travel. Depressing front of pedal releases digging brake and causes forward travel. Depressing rear of pedal releases digging brake and causes reverse travel. Gear range selection, engine speed and extent of pedal depression determine travel speed. Digging brake is applied automatically when travel pedal is released.

4. Steering pedal right side of pedal causes right turn. and depressing left side of pedal causes left turn.

5. Use EMERGENCY BRAKE to stop carrier if automatic digging brake fails. Move emergency

Preparing Upperstructure for Conventional Carrier Operation

1. Test brakes (refer to page 7).

2. With bucket opened fully, retract boom (watch bucket clearance) and position in boom rest as shown on page 7. Secure boom and bucket using hold-down devices as necessary.

3. Allow engine to cool by running at idle speed for a few minutes. Stop engine.

4. Be sure travel and steering pedals are in neutral position and emergency brake is released.

Preparing Carrier for Conventional Operation

1. Apply parking brake.

2. Shift transmission to neutral.

3. Move DIGGING BRAKE toggle to OFF position.

4. If condition permit, move inter-axle differential toggle to UNLOCK position.

5. Shift transfer case to engage or disengage front drive axle as appropriate for driving conditions (if so equipped).

PARKING THE GRADALL

Precautions:

Avoid parking on banks or near an excavation.

Avoid parking on roads or highways. If It cannot be avoided be sure to display warning flags during day and flares or flashing lights at night.

Position boom In boom rest; never leave machine with boom air.

Park on level ground and block wheels.

If parking on a slope cannot be avoided, position unit at right angle to slope and block wheels.

Parking Procedure

1. Using service brake, stop unit in appropriate parking area.
2. Set PARKING BRAKE to ON..
3. Allow engine to cool at idle speed for a few minutes and then turn off.
4. Shift transmission to first gear.
5. Block carrier wheels as extra precaution against rolling.
6. Fill fuel tank to minimize condensation.
7. Lock carrier and upperstructure cabs and install protective window covers if available.
8. Disconnect batteries if unit is in an area where tampering seems possible.

IN CASE OF TROUBLE

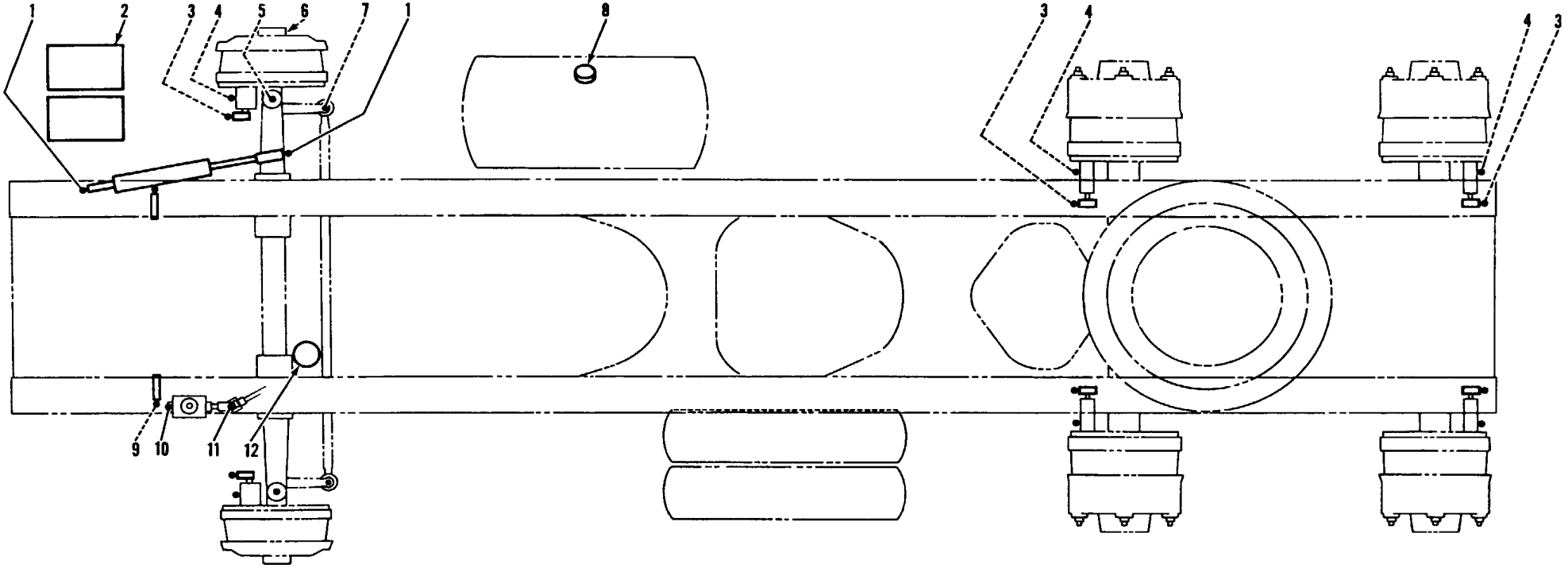
1. Park unit in a safe area, apply parking brake and block wheels. Display warning flags, flares or flashing lights as necessary.
2. Contact supervisor and advise:

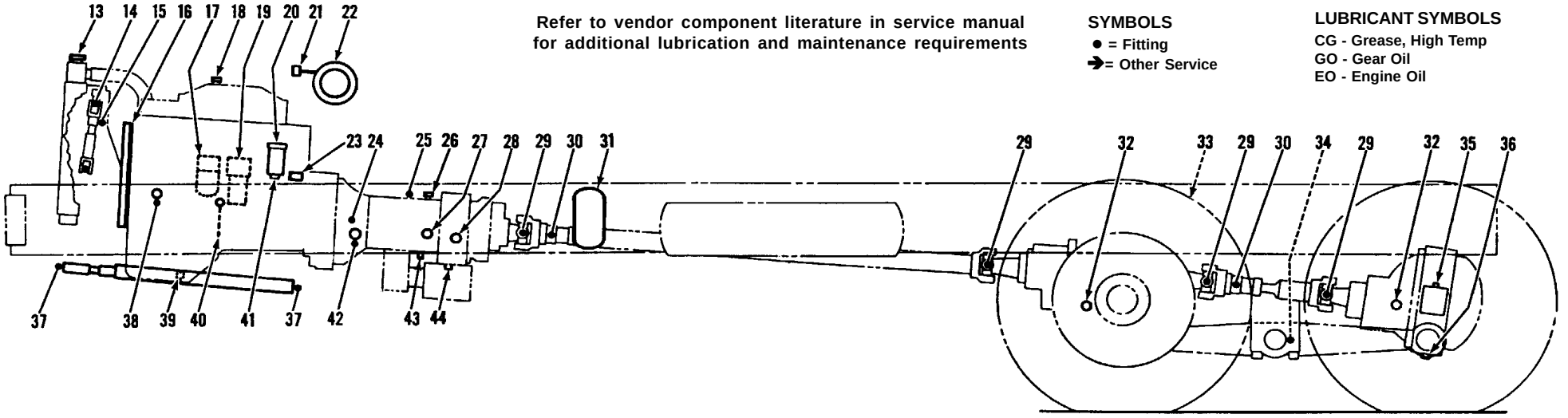
   Nature of problem
   Location of unit
   Where you can be reached by phone

Towing

Should it become necessary to tow carrier, have maintenance personnel remove propeller shafts between axles and transmission or transfer case (if so equipped). Store propeller shafts in a safe location.

6X4 CARRIER LUBRICATION & MAINTENANCE DIAGRAM





Refer to vendor component literature in service manual for additional lubrication and maintenance requirements

SYMBOLS

- ● = Fitting
- ➔= Other Service

LUBRICANT SYMBOLS

CG - Grease, High Temp
GO - Gear Oil
EO - Engine Oil

Refer to vendor component literature in service manual for additional lubrication and maintenance requirements.

Item	Lube Symbol	No. of Points
Daily Lubrication & Maintenance		
8. Fuel Tank (till at end of work shift to minimize condensation	-	1
13. Radiator Filler Cap (check coolant level and replenish as req'd)	-	1
21. Air Cleaner Condition Indicator (observe indicator & clean or replace air cleaner element as req'd - item 22 is air cleaner)	-	1
33. Tires (check for damage & pressure): Front Tires: 15.00 x 22.5,14 ply @ 85 psi; 10.00x 20, 14 ply @ 1W psi; Rear Tire: 10.W x 20,14 ply @ 90 psi; 9.00 x 20,12 ply @ 85 psi; 10.00 x 20, 14 ply @ 90 psi.	-	10
40. Engine Crankcase Dipstick (check level & refill as req'd)	EO	1
At End of First 20 Hours		
17. Engine Oil Filter (replace)	-	1
39. Engine Crankcase Drain Plug (drain & refill)	EO	1
43 & 44. Transmission Front & Rear Drain Plugs (drain front & rear sections & replace drain plugs - items 27 & 28 are level plugs - Fill each section to its own level)	GO	2
Weekly Lubrication & Maintenance (includes daily services)		
31. Automatic Reservoir Drain Valves (refer to page 19 of this manual)	-	1
41. Fuel Filter Water Drain (drain water from filter)	-	-
At End of First 30 Days		
● Check torque of all items listed in torque chart page 36.	-	2
Monthly Lubrication & Maintenance (includes all daily and weekly services)		
1. Steering Cylinder Pivots	CG	2
2. Battery (check electrolyte level and replenish as req'd)	-	2
3. Slack Adjuster	CG	6
5. King Pin Bearings	CG	6
7. Tie Rod Ends	CG	2
9. Spring Anchor Pin	CG	2
10. Shift Tower Shaft	CG	2
11. Shift Linkage Universal Joint	CG	1
12. Power Steering Reservoir (check level & refill as req'd)	EQ	1
14. Steering Universal Joints	CG	2
15. Steering Shaft Splines	CG	1
24. Clutch Throwout Bearing (lubricate sparingly)	CG	1

Item	Lube Symbol	Lube Symbol
Monthly Lubrication & Maintenance (continued)		
25. Shift Linkage (at transmission)	CG	3
27. Transmission Front Fill & Level Plug (check level & refill as req'd)	GO	1
28. Transmission Rear Fill & Level Plug (check level & refill as req'd)	GO	1
29. Universal Joints	CG	4
30. Drive Shaft Splines	CG	2
31. Air Drier (refer to page 20 of this manual)	-	1
32. Differential Fill and Level Plug (check and fill to level)	GO	2
34. Walking Beam Pivot	CG	2
37. Drag Link Ball Joints	Cg	2
38. Clutch Pedal Pivot Shaft	CG	2
42. Clutch Trowout Shaft Bearing	CG	2
Semi-Annual Lubrication & Maintenance (includes all daily, weekly & monthly services)		
4. Brake Camshaft (lubricate sparingly)	CG	6
6. Wheel Bearings (front axle) (remove, clean, pack and install)	CG	2
16. Engine Drive Belt (check condition and tension - replace or adjust as req'd)	-	1
17. Engine Oil Filter (replace elements at each oil change - 250 hours maximum)	-	2
26. Transmission Breather (remove, clean and install)	-	1
35. Differential Breather (remove, clean and install)	-	2
39. Crankcase Drain Plug (drain and refill to level on dipstick - item 18 is oil filter cap- 250 hours maximum)	EQ	1
● Check torque of all items listed in torque chart, page 36.	-	-
Annual Lubrication & Maintenance (includes all daily, weekly, monthly & semi-annual services)		
12. Steering system (drain & refill to level)	EQ	1
19. Coolant Filter (replace element)	-	1
20. Fuel Filter (replace element)	-	1
23. Fuel Strainer (clean or replace element)	-	1
31. Air Drier (refer to page 20 of this manual)	-	1
36. Differential Drain Plug (drain and refill)	GO	2
43 & 44. Transmission Front and Rear Drain Plug (drain front & rear sections & replace drain plugs - items 27 & 28 are level plugs - Fill each section to its own level)	GO	2

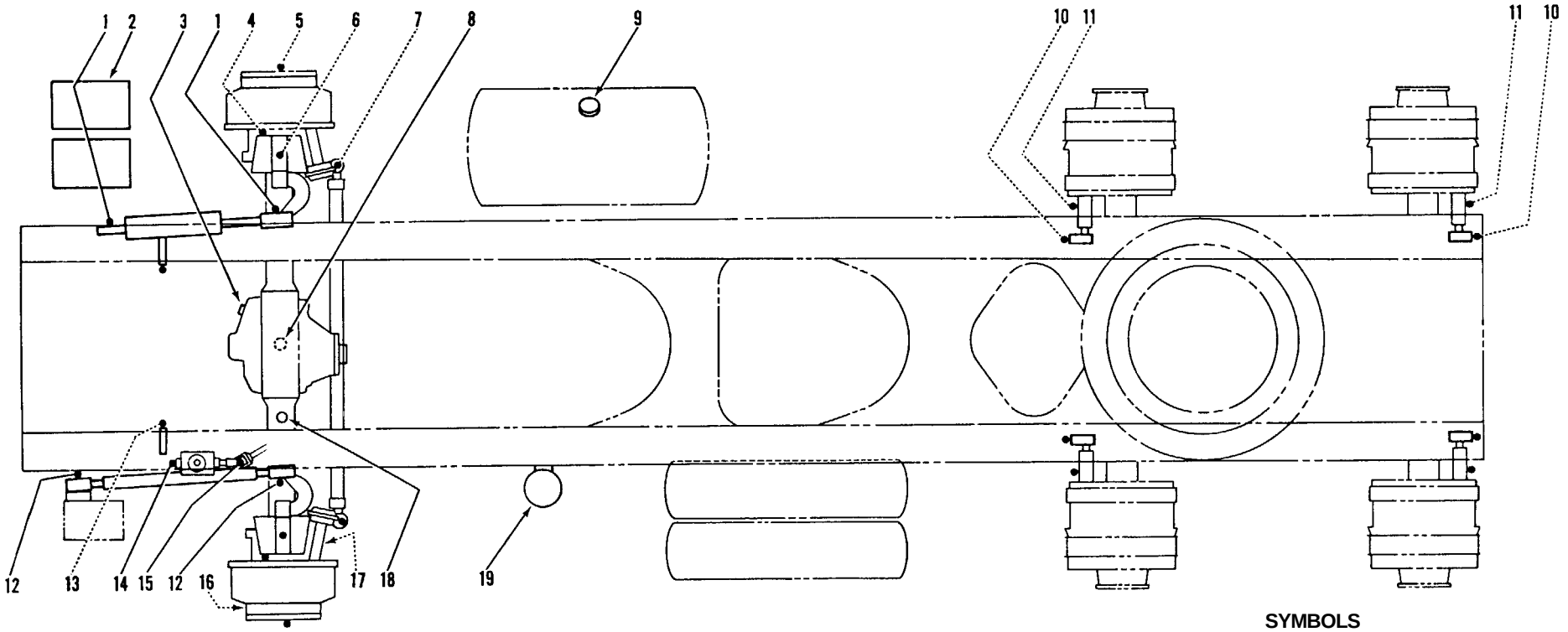
LUBRICATION NOTE

Clean lubrication fittings before lubricating.
Intervals shown are for normal (8 hour day) usage and conditions. Adjust intervals for abnormal usage and conditions.

Lubricate points indicated leaders on both side of unit.
Drain engine and gear cases only after operation when lubricant is hot.
Check lubricant levels when lubricant is cool.

Clean filter and air cleaner housing and reusable elements using cleaning solvent or diesel fuel. Dry components thoroughly using a lint free cloth.
Apply a light coating of engine oil to all linkage pivot points.
See recommended lubricants. Page 36.

6X6 CARRIER LUBRICATION & MAINTENANCE DIAGRAM



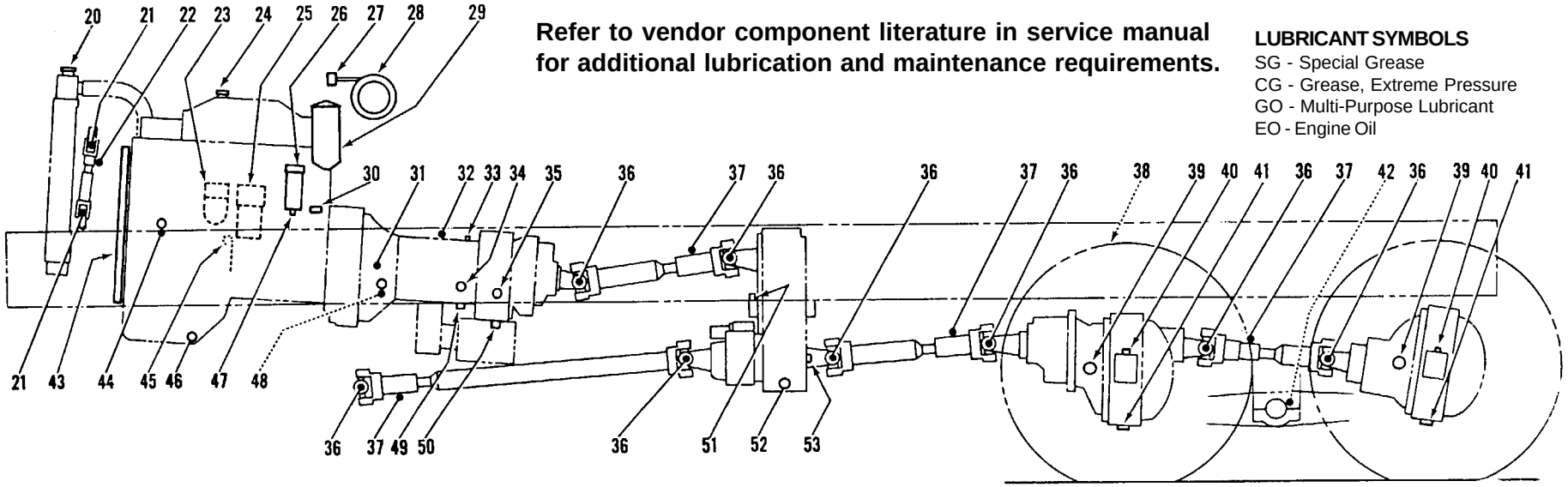
SYMBOLS

- • . = Fitting
- ➔ = Other Service

Refer to vendor component literature in service manual for additional lubrication and maintenance requirements.

LUBRICANT SYMBOLS

SG - Special Grease
CG - Grease, Extreme Pressure
GO - Multi-Purpose Lubricant
EO - Engine Oil



	Item	Lube Symbol	No. of Points
	Daily Lubrication & Maintenance		
9.	Fuel Tank (fill at end of work shift to minimize condensation)	-	1
20.	Radiator Filler Cap (check coolant level and replenish as req'd)	-	1
27.	Air Cleaner Condition Indicator(observe indicator &clean or replace air cleaner element as req'd - item 28 is air cleaner)	-	1
38.	Tires(check for damage & pressure - Front: 15.00 x 22.5, 16 ply @ 100 psi or 10.00 x 20, 14 ply @ 90 psi - Rear: 10.00 x 20, 14 ply @ 90 psi	-	10
45.	Engine Crankcase Dipstick (check level & refill as req'd - item 24 is filler cap)	EO	1
	At End of First 20 Hours		
23.	Engine Oil Filter (replace)	-	1
46.	Engine Crankcase Drain Plug (drain & refill)	EO	1
49 & 50.	Transmission Front & Rear Drain Plugs (drain front & rear sections & replace drain plugs - items 34 & 35 are level plugs - fill each section to its own level)	GO	2
52.	Transfer Case Drain Plug (drain & refill to level - item 53 is level plug)	GO	1
	Weekly Lubrication & Maintenance (includes all daily services)		
47.	Fuel Filter Water Drain (drain water from filter)	-	1
	At End of First 30 Days		
	Check torque of all items listed in torque chart, page 36	-	-
	Monthly Lubrication & Maintenance includes all daily and weekly service)		
1.	Steering Cylinder Pivots	CG	2
2.	Battery (check electrolyte level and replenish as req'd)	-	2
3.	Differential Level Plug (check level & refill as req'd)	GO	1
4.	Universal Joint (turn wheels to extreme right & left to uncover fittings)	CG	2
5.	Front Axle Drive Spline	CG	2
6.	Wheel Pivot Trunnions	GG	4
7.	Tie Rod Ends	CG	2
10.	Slack Adjuster	CG	4
12.	Drag Link Ball Joints	CG	2
13.	Spring Anchor Pin	CG	2
14.	Shift Tower Shaft	CG	1
15.	Shift Linkage Universal Joint	CG	1
19.	Air Drier (check for excessive moisture - refer to pg. 20 of this manual)	-	1
21.	Steering Universal Joints	CG	2
22.	Steering Shaft Splines	CG	1
29.	Power Steering Reservoir (check level & refill as req'd)	ATF	1
31.	Clutch Throwout Bearing (lubricate sparingly)	CG	1

	Item	Lube Symbol	No. of Points
	Monthly Lubrication & Maintenance (continued)		
32.	Shift Linkage f,at transmission)	CG	3
34.	Transmission Front Fill & Level Plug (check level & refill as req'd)	GO	1
35.	Transmission Rear Fill & Level Plug (check level & refill as req'd)	GO	1
36.	Universal Joints	CG	8
37.	Drive Shaft Splines	CG	4
39.	Differential Fill and Level Plug (check and fill to level)	GO	2
42.	Walking Beam Pivot	CG	2
44.	Clutch Pedal Pivot Shaft	CG	2
48.	Clutch Throwout Shaft Bearing	CG	2
53.	Transfer Case Fill & Level Plug (check level & refill as req'd)	GO	1
	Semi-Annual Lubrication & Maintenance (includes all daily, weekly & monthly services)		
11.	Brake Camshaft (lubricate sparingly)	CG	6
18.	Differential Breather (remove, clean & install)	-	1
23.	Engine Oil Filter (replace element at each oil change - 250 hours maximum)	-	1
33.	Transmission Breather (remove, clean and install)	-	1
40.	Differential Breather (remove, clean and install)	-	2
43.	Engine Drive Belt (check condition and tension - replace or adjust as req'd)	-	1
46.	Crankcase Drain Plug (drain and refill to level on dipstick - item 24 is oil filler cap-250 hours maximum)	EO	O
51.	Transfer Case Breather (remove, clean & install)	-	1
	Check torque of all items listed in torque chart - page 36	-	-
	Annual Lubrication & Maintenance (includes all daily, weekly, monthly & semi-annual services)		
8.	Differential Drain Plug (drain & refill - item 3 is fill & level plug)	GO	1
16.	Wheel Bearings (front axle) (remove, clean, pack and install)	CG	2
17.	Wedge Brakes (lube per Rockwell Lubrication Manual)	SG	2
19.	Air Drier (service or replace cartridge - refer to page 20 of this manual)	-	1
25.	Coolant Filter (replace element)	-	1
26.	Fuel Filter (replace element)	-	1
29.	Steering System (drain & refill to level)	ATF	1
30.	Fuel Strainer (clean or replace element)	-	1
41.	Differential Drain Plug (drain and refill)	GO	2
49 & 50.	Transmission Front & Rear Drain Plugs (drain front & rear sections & replace drain plugs - items 34 & 35 are fill & level plugs - fill each section to its own level)	GO	2
52.	Transfer Case Drain Plug (drain and refill to level - item 53 is fill & level plug)	GO	1

Refer to vendor component literature in service manual for additional lubrication and maintenance requirements.

LUBRICATION NOTES

Clean lubrication fittings before lubricating.
Intervals shown are for normal (8 hour day) usage and conditions. Ad just intervals for abnormal usage and conditions.
See recommended lubricants. Page 36.

Lubricate points indicated by dotted leaders on both side of unit.
Drain engine and gear cases only after operation when lubricant is hot.
Check lubricant levels when lubricant is cool.

Clean filter and air cleaner housing and reusable elements using cleaning solvent or diesel fuel. Dry components thoroughly using a lint free cloth.
Apply a light coating of engine oil to all linkage pivot points.

Recommended Lubricants & Capacities

Application	Symbol	When Used	Grade	Specifications	Capacities**	
					English	Liters
Engine Crankcase: (Cummins)	EO (engine oil)	*	*	*	23.7 quarts	22.4
Cooling System: 6CT 8.3 6CTA 8.3	—	—	—	—	27 quarts 28 quarts	25.5 26.5
P.T.O. & Transmission Combination:	GO (gear lubricant)	*	*	*	26 pints initial 16 pints refill	12.3 7.6
Transfer Case (6x6 only)	GO (gear lubricant)	*	*	*	10 quarts	9.5
Tandem Axle (forward)	GO (gear lubricant)	*	*	*	34 pints	16
Tandem Axle (rear)	GO (gear lubricant)	*	*	*	31 pints	14.5
Front Drive Axle (6x6 only)	GO (gear lubricant)	*	*	*	23 pints	11
Grease Fittings Wheel Bearings	CG (extreme pressure lube)	All Year	—	MIL-G-24139	—	—
Steering Reservoir	ATF (auto. trans. fluid)	All Year	—	Dexron	—	—
Wedge Brakes (6x6 only)	SG (special grease)	All Year	*	*	—	—

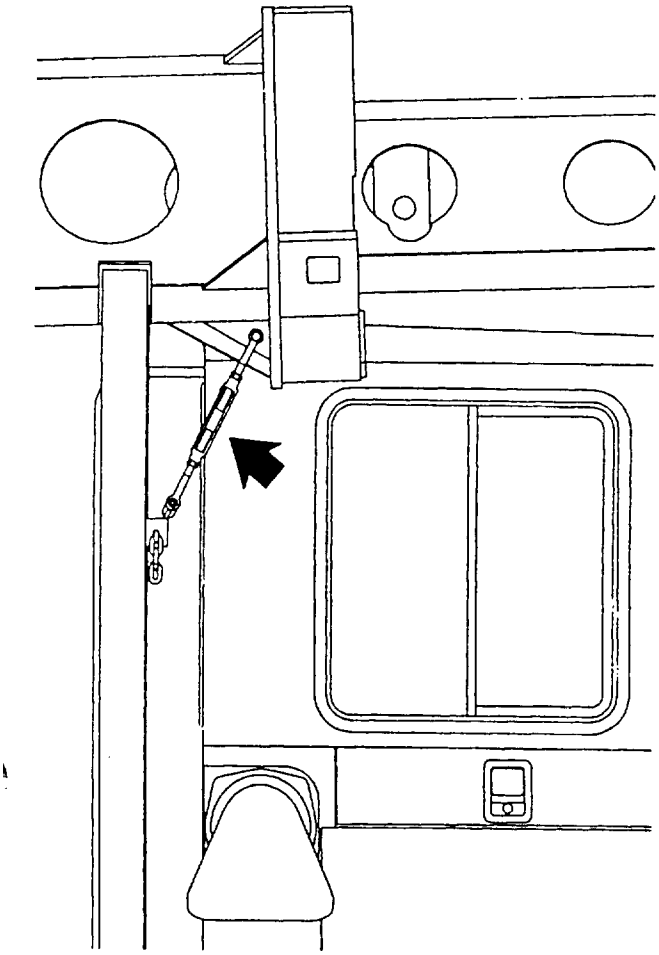
*Refer to manufacturer's service literature for this information
**Capacities are approximate - check level to be sure

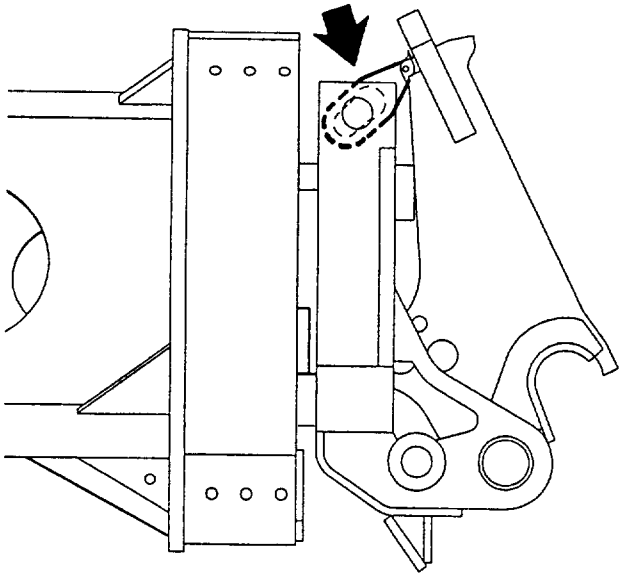
TORQUE CHART

Check torque using an accurate torque wrench to apply maximum torque value shown. DO NOT EXCEED MAXIMUM TORQUE. Exceeding maximum torque may cause failure of fastener.

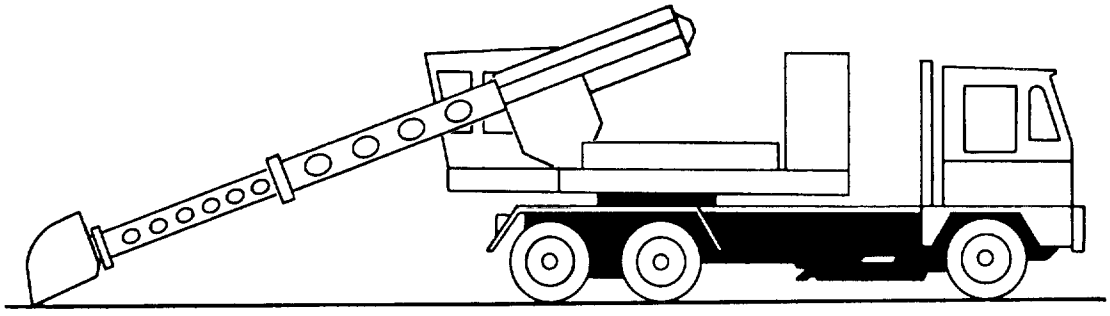
ITEM	QTY.	THREAD SIZE (GRADE)	TORQUE (lubricated)			
			POUND/FEET		NEWTON/METRES	
			MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
Spring U-Bolt Nuts	8	¾-16 (-)	300	325	408	442
Steering Gear Box	4	⅞-14 (8)	390	410	530	558
Wheel Lug Nuts (spoke wheel):						
6 x 4 Front	All	-	175	185	238	252
6 x 4 Rear	All	-	200	215	272	292
6 x 6 Front	All	-	370	395	503	537
6 x 6 Rear	All	-	290	315	394	428
Wheel Lub Nuts (disc wheel)	All	-	450	500	612	680

SECURING BOOM & ATTACHMENT FOR TRAVEL





IF YOU GET STUCK



If unit becomes stuck in soft ground you can use the boom to help free it.

Position carrier and upperstructure controls for remote control operation.

Position boom over rear of carrier (centered over rear to prevent tipping) and imbed bucket in ground.

While actuating travel pedal in appropriate direction, extend or retract boom as required to help push or pull unit to solid ground. Raise or lower boom as necessary to keep rear wheels in proper contact with ground.

CALIFORNIA

Proposition 65 Warning

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Wash hands after handling.

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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